Fachhochschule Salzburg University of Applied Sciences

Virtual Project Management

DIPLOMA THESIS

Degree Program Information Technology and System Management

at

Salzburg University of Applied Sciences

submitted by	**Carlos Jambrina Geisler**
Evaluator	Ass. Prof. DI(FH) DI Peter Haber
2nd Evaluator	Prof. MMag. Dr. Manfred Mayr
Head of Degree Program:	Prof. DI Dr. Gerhard Jöchtl

Salzburg, 8. Nov. 2010

Affidavit

Herewith I declare that I have written the present diploma thesis fully on my own and that I have not used any other sources apart from those given. I also state, that all relevant areas, including tables, maps and figures, which are similar to other works in printed form or out of the Internet have been marked as foreign work throughout the thesis.

....

Date Signatur

Acknowledgment

I dedicate this Thesis to my beloved family that supported me along my studies and in fact along all my life. To my father who taught me that knowledge is a gift, but also that the acquiring of knowledge would never end. I miss you so much. To my mother who shows me her unconditional love every day, to my sister who is always on my side, to Iva whose devoted love I barely deserve.

I am really thankful to FH-Ass.Prof. DI (FH) DI Peter Haber, my evaluator for his support, wise advices, humour and help, especially in the difficult moments. I would also like to thank to FH-Prof. MMag. Dr. Manfred Mayr, my second evaluator, for his kindness, help and support.

Abstract

To understand *Virtual Project Management* (vPM) it is necessary previously to understand the basics of *Project Management* (PM). vPM could be understood as an enhancement or extension of PM, because it uses the new available telecommunication technologies. Meanwhile projects take place inside of the same company with workers of this company, vPM take place with workers which are not in the same company, maybe not even in the same country or continent. This leads to several interaction problems which could origin the failure of the virtual project if they are not properly managed.

vPM is required when one company is not able to do the project by themselves, whatever the reasons may be. High skills are expected from the team members of a vPM and especially from the virtual project manager who has the huge task of planning, developing, controlling and finishing the vPM.

Resumen

Para comprender Virtual Project Management (vPM) es necesario entender previamente los fundamentos de Project Management (PM). vPM se puede considerar como una ampliación o una extensión de PM porque hace uso de las nuevas tecnologías de la comunicación. Mientras que un PM generalmente tiene lugar dentro de la empresa con expertos de la propia empresa, en un virtual Project Management trabajan expertos que no tan solo no pertenecen a la propia empresa sino que es muy posible que se hallen en otra ciudad, país o inclusive continente. Esto conlleva posibles problemas que podrían llevar al fracaso del proyecto virtual si el manager no hace nada para remediarlo.

Un vPM es necesario cuando la empresa no es capaz de realizarlo con sus propios medios, sea por los motivos que sea. De los miembros del equipo del vPM se esperan grandes habilidades, especialmente del Project manager el cual tiene que llevar a cabo la enorme tarea de planificar, desarrollar, controlar y finalizar el vPM.

PART I
Introduction and Definitions about virtual Project Management

1st Chapter

Origins of Project management and the evolution to virtual project management

Solving mathematics, physics or whatever kind of problems, was always something fascinating. With somebody's help, more complex problems became solvable. At the university, working with friends on problems showed up that different points of view were helpful to a solution. Meanwhile trying to figure out how more difficult problems or even interdisciplinary problems could be solved, somebody talked about project management, which looked to be a great idea and the way to solve complex issues.

The fact that a project was being managed only within one company was somehow a problem while trying to solve complex often interdisciplinary problems because of a lack of competence of the experts of the company or just not having people with the necessary know how. Different opinions and different points of view could be the clue to solve complex situations which may look to have reached a no go point. Often the internal structure of the company or the focus of the company doesn't help to keep on developing the solution to a problem. At this point external help might be necessary to solve a problem. One way to get to this knowhow, to these different points of views is *Virtual Project Management* (vPM). vPM takes profit of working online all over the world. This allows enrolling the most skilled people for the vPM and getting an effective and fast solution to complex issues.

This is a fascinating task with an enormous potential but also high risks derived from the situations which happen when different people from different backgrounds, expertise and cultures work together. The chance to choose the best experts possible all over the world to face a new complex task is amazing. This was fascinating to me.

This thesis shows up what virtual project management is about, the main issues which may happen along the development of a virtual project, how to face them and how to solve them to ensure a successful finishing of the virtual project. The structure of this work is divided into three main parts.

The first part is the introduction to vPM and PM. Here there are defined briefly and clearly the main concepts of both kinds of PM. The rest of the necessary concepts will be also defined along the text as soon as needed. In this part there are also introduced the main methods used to manage a project.

The second part of this work analyzes the similarities and differences between vPM and PM. Because vPM is an evolution of PM, first are analyzed the main aspects of project management and the similarities between PM and vPM. There is covered the whole sum of a project management, from the first steps where the project manager is trying to figure out how to prepare everything needed for the project until the closure of the project. The main steps described here are the project life cycle, the initiation of the project and the stages of the project management: Planning, Executing, Controlling and ending of the project. The skills of a project manager play also an important role in this part of the work.
Next the differences between vPM and PM are analyzed. This direct comparison makes it easy to figure out the characteristics of a vPM.

The third part of this work shows how to start a vPM step by step from a practical point of view. The steps that should be followed to manage a virtual project are exposed.

Finally the conclusions as well as some future tendencies and some advises of how make it easier to manage a virtual project management are shown.

1.1. Origins of Project management

Despite the fact that project management may be something which is supposed to be pretty recent in history, there are records that show that some of the project management strategies were already described in “The art of war” from Sun Tzsu [10].

An example of ancient project management was the building of the Egyptian great pyramid at Gizeh. The hieroglyphics on the stones show that the way the Egyptians organized the workers in the construction of the pyramid could be compared to the organization of teams into a project. Some workers were there all the time – these would be the core team in a project – and the workers which were called or forced when they were needed – these would be the external teams. The workers rotation was every 12 weeks, which could be compared with the time usually project teams work within a project [10].

Other examples could be the building of the railroad system in the United States, which included a starting point and a deadline (the meeting of both companies on the track), a defined budget, team management, logistics as well as risk management were needed [10].

With time the projects became more complex and the risks involved were not affordable for private companies. This is the point where the state decided to take the risk because the project had to be done. This is the case of the military [10]:

- The United States program Polaris.
- NASA´s Apollo space program.
- NASA´s Space shuttle.
- Strategic defence initiative (Star Wars).

For these programs were developed and introduced most of the knowledge, methods, techniques, strategies and tools which are nowadays widely used in project management [10].

2nd Chapter
Definitions of topics of virtual project management

In this chapter there will be defined briefly the most important concepts of virtual project management as well as, if necessary, their mutual relationship.

2.1. What is a project?

There are different definitions of what a project is:

> Greg Horine defines a project as the work performed by an organization one time to produce a unique outcome. By "one time" means that the work has a definite beginning and a definite end, and by "unique," means that the work result is different in one or more ways from anything the organization has produced before [1].
>
> The *German institute of normalization* (DIN) defines a project in its norm DIN 69901-5:2009 as a plan which is distinguished in its totality basically by the uniqueness of its conditions which constrain it [2].
>
> The *Project Management Institute* (PMI) in the PMBoK® Guide defines a project as „...a temporary endeavour undertaken to create a unique product or service. Temporary means that every project has a definite beginning and a definite end. Unique means that the product or service is different in some distinguishing way from all other products or services"[3, Page 4].

From these definitions it possible to conclude that some of the main characteristics of a project are:

- It is a unique activity, which means that at least in some parts it has never been done in the same way before.
- It has a clearly defined beginning and ending.
- It has special conditions

Other terms must also be discussed to fulfil the concept of project. These terms are [16]:

- *Time*
  There is a clear start and deadline of the project.

- *Budget*
  It is defined and the virtual project manager has to settle with it.

- *Scope*
  Is the list of deliverables or features that have been arranged to deliver at the deadline.

- *Quality*
  It is not only referred to the quality of the deliverables or features but also to the quality of the approach of the project.

These four terms conform a balance which the virtual project manager has to deal with. A change in any of these terms affects also the other terms, they are in a balance as shown in the figure 1:

Figure 1 The balance quadrant, adapted from [16]

With this diagram it is easy to realize that if, for instance, the budget changes, this change affects in the same way the other three terms unbalancing the quadrant. The circle would shrink or increase depending on the kind of change applied to one of the terms. Any change would make the project becoming more expensive, taking more time, changing its quality or varying the scope [16].

2.2. What is not a project?

Wrong concepts of project management are widespread which gives people the idea that project management is boring, too hard or lasts too long [16].
PM is sometimes conceived by workers as a distraction from "real work" which has to be done. This leads to not have an appropriate focus of how a project should be managed, building something which doesn´t accomplish the customer requirements, costs twice as much as planned or is finished too late. This is frustrating because a lot of work has been done for nothing [16].

If a project is managed following strictly the rules of how a project should be managed, it is probably going to last for a long time. The clue is to mix the science of how a project should be managed with the art to manage it, this means, mixing what you should do with what you need to do. The experience helps to learn the art of managing a project and how to make it lasting less [16].

Many project managers make the mistake of managing the team members of the project as if they were also a project. People are way more complicated than projects and cannot be managed just like a project. There for, there is specialized literature which covers this topic like "Managing Humans"[1].

It is different to treat a typical daily problem in ongoing operations than in projects. An incident in a live system has a completely different treatment than an issue in a project.

People use to confuse a project with two common terms [4]:

- *Process*
  A process is a routine which is repeated often to perform a particular function. It is not a one-time activity which is performed to achieve a specific result. A Process shows how a function has to be done every time.

- *Program*:
  Is a function which sets different possible goals and thus can never be completed (only one goal is reachable each time the program is run). A program can also be a group of specified projects that achieve a common goal.

[1] Michael Lopp, *Managing Humans: Biting and Humorous Tales of a Software Engineering Manager,* APRESS, 2007

2.3. What is management?

Horine defines management in several ways [1]:

> The science and art to plan, organize, implement and control the work of a project to meet the goals and objectives of the organizations.
>
> The process of defining a project, developing and executing the plan, monitoring the progress, managing risks and taking corrective actions.
>
> The process of leading a team that has never before worked together to accomplish something that has never before been done with a limited amount of time and budget.

As a sum of these definitions, management is the planning, development and controlling of a project which has never been done before and with people working in a team who never before had been working together, in a limited amount of time and budget.

2.4. What is project management?

As well as in the two previous cases, there are several definitions of project management:

> The PMI defines project management as: "...the application of knowledge, skills, tools and techniques to project activities to meet project requirements. Project management is accomplishing through the use of processes such as: initiating, planning, executing, controlling and closing" [3, Page 6].
>
> Portny definition of PM is: "...the processes of guiding a project from its beginning through its performance to its closure" [4, Page 14].
>
> Kertzner defines project management as directing the efforts of project teams through the lifecycle of the project to deliver a completed product and/ or service [5].

To sum up, project management is the application of several processes to guide the project through the whole life cycle (see point 2.8), from the beginning until its closure to deliver a completed product and/or service.

2.5. What is virtual project management?

A project doesn't become virtual because *virtual communication tools* are used. Nowadays virtual communication tools like e-mail, chat or videoconferences are used everywhere, even in between workers of the same company, independently of the size of the company.
A project becomes virtual only when the teams become virtual. A team becomes virtual when the team members are working in different places; these places may be in the same city or in different countries with remarkable cultural differences like time zone, language, habits [6].

Finally, a virtual project management is the application of several processes to guide virtual teams along the project, from the beginning until the closure of the virtual project.

2.6. Kinds of virtual project management

There are mainly two kinds of virtual project management: distributed and virtual corporation management [7]:

- *Distributed*
  One project in many locations. One company gets the task to do a virtual project. The manager of the vPM organizes the whole project and enrols the needed workers. For the whole duration of the project, only one project manager has the control of the project.

- *Virtual Corporation Management* (vCM)
  Many organizations in many locations. The size or the characteristics of the project are such that not only one company is able to do it by its own. More companies have to work together in the project. Each of this company wants either to have its own project manager or take actively part in taking decisions. The project manager has to get to a commitment with these companies for a governance model in order to proceed with the virtual project.

Both kinds of vPM are shown in the next figure:

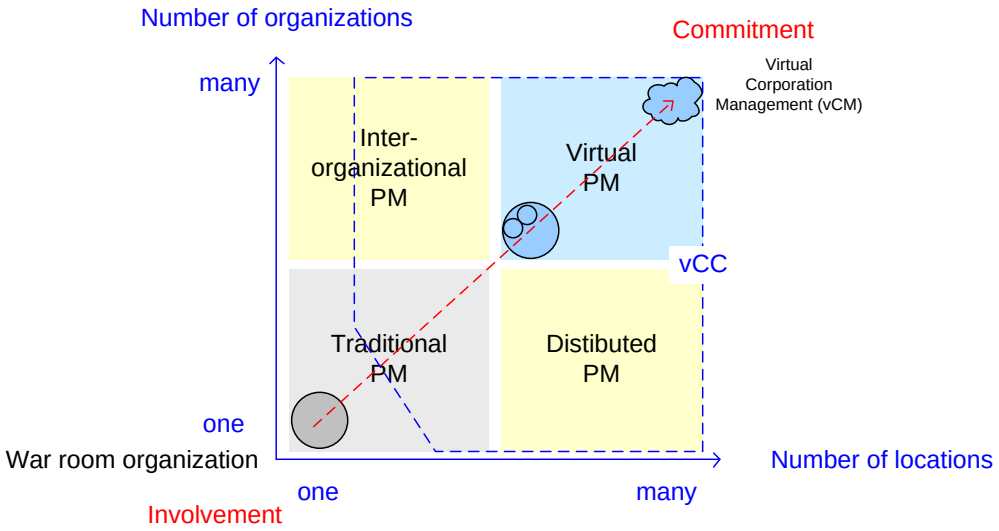


Figure 2 Several kinds of PM and vPM.

2.7. What are project management methodologies and frameworks?

Webster defines a methodology as a body of methods, rules, and postulates employed by a discipline or a particular set of procedures [8].

A methodology may comprehend a set of tools, conventions and best practices that attempt to make the development of a project easier [8].

Kerzner defines a methodology into best practices: "A best practice begins with an idea that there is a technique, process, method, or activity that can be more effective at delivering an outcome than any other approach and provides us with the desired outcome with fewer problems and unforeseen complications. As a result, we supposedly end up with the most efficient and effective way of accomplishing a task based upon a repeatable process that has been proven over time for a large number of people and/or projects" [5, Page 18].

The method should be set at the beginning of the virtual project by the virtual project manager in order to establish an easy and known way to solve routine tasks.

There are several frameworks available on the market. Here there will be commented just a few of them:

2.7.1. PRINCE2 (PRojects IN Controlled Environments version 2)

PRINCE2 is a project management method that covers the management, control and organization of a project. PRINCE2 is a process-based method for project management. It provides a

method for project management within a well-defined framework. It describes several procedures like how to design and control a project, hoe to react when problems happen, how to coordinate people among others. Each process is specified with all the relevant data and results as well as specific goals and milestones, which helps to control the project. PRINCE2 is a de facto standard used extensively by the UK Government and is widely recognized and used in the private sector, both in the UK and internationally. PRINCE2 is a registered trademark of OGC[2]. The key features of PRINCE2 are the focus on business justification, a defined organization structure for the project management team, its product-based planning approach; its emphasis on dividing the project into manageable and controllable stages; and its flexibility to be applied at a level appropriate to the project [9].

PRINCE2 defines 40 separate activities and organizes these into seven processes [9]:

- Starting up a project
- Initiating a project
- Directing a project
- Controlling a stage
- Managing stage boundaries
- Managing product delivery
- Closing a project.

These methods and their flow of information are represented in the figure 3 [11]:

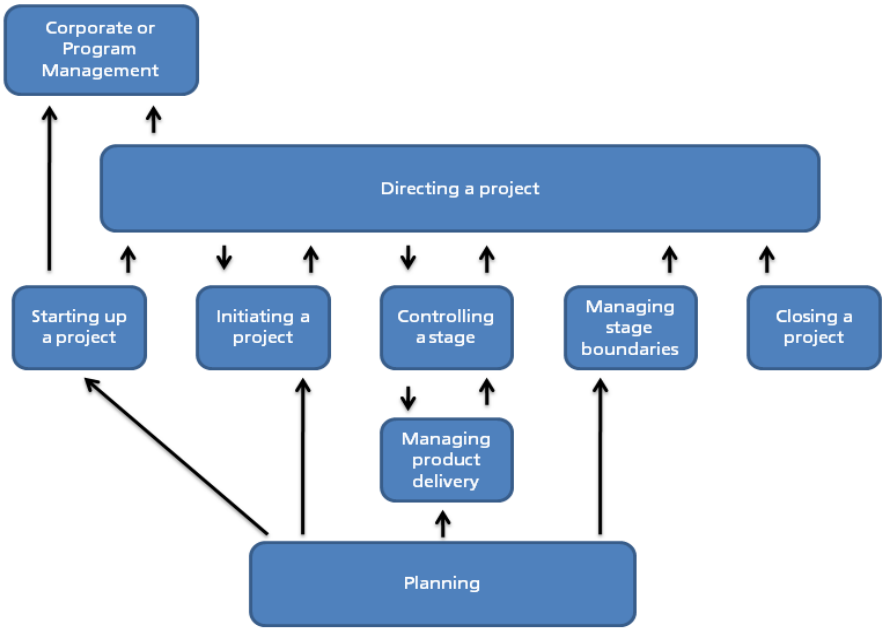


Figure 3 PRINCE2 model

[2] Office of Government Commerce UK : http://www.ogc.gov.uk/

2.7.2. HERMES

was based on a German V model. It is a development of the Swiss government of a software development methodology. That's why at the beginning it was used mainly for software projects in Switzerland. Now it has become an overall Project management phase-based method. HERMES can be adapted to each project by using tools like the PowerUser tool. It is an open standard of the Swiss Federal administration [12].

HERMES procedures are oriented to results and goals. By taking care of the needs to accomplish the expected objectives of all the team members, it creates the right conditions for coordination and collaboration between them, providing a common language [12].

The structure of the development and execution of a project with HERMES is specified by the project phases and results, from which derive the required project activities and responsibilities. The methods name and describe the nature of the phase-specific activities. HERMES improves transparency, eases planning and execution of projects. The phase model enforces a well structured project. It divides the whole process in 6 phases: Initialization, Pre-analysis, Concept, Realization, Deployment and Finalization [12].

The project phases orientate themselves around the results to be created and around the decision-making points of a phase to emerge from them, where the results of every phase run together. The graphic shows the 6 phases [13]:

Figure 4: Project Phase of Hermes

HERMES distinguishes two types of projects [13]:

- System development for solution implementation from scratch
- System adaptation for purchased solutions.

The phase model is different for each project type, as shown on the figure 5:

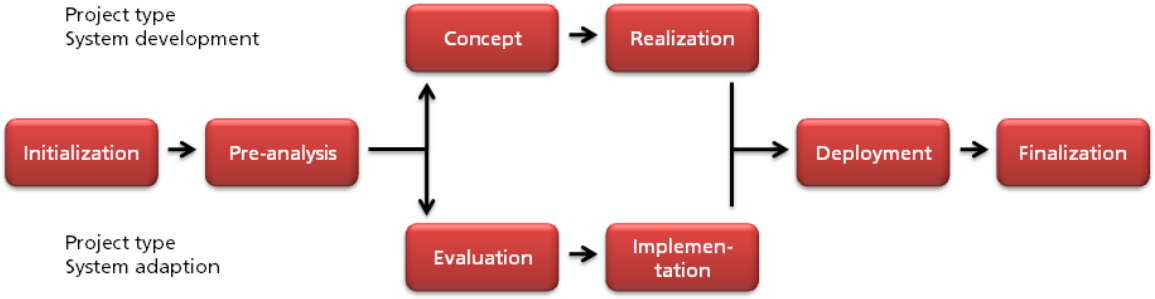


Figure 5 HERMES phase model, adapted from [13]

The transverse functions and processes are described in the form of sub-models. They are the same independently of the project type. They apply to most information and communication technologies projects with project management, quality assurance, risk management, configuration management and project marketing.

2.7.3. Capability Maturity Model Integration

The *Capability Maturity Model Integration* (CMMI) is a process improvement approach that helps organizations to improve their performance. It is similar to ISO-9001, AS-9100 and other industrial process standards [21]. It was developed by a group of experts from industry, government, and the Software Engineering Institute (SEI) at Carnegie Mellon University (CMU). CMMI can be used to guide process improvement across a project, a division, or an entire organization [19].

CMMI in software engineering and organizational development is a process improvement approach that provides organizations with the essential elements for effective process improvement. CMMI is a trademark owned by Software Engineering Institute of Carnegie Mellon University. According to the Software Engineering Institute[3], CMMI helps to integrate organizational functions that are traditionally separated, offers guidance for quality processes, sets the goals and priorities of the improvement process and sets a reference point for the evaluation of the current processes [19].

[3] http://www.sei.cmu.edu/

CMMI currently addresses three areas of interest:

- Product and service development — CMMI for Development (CMMI-DEV)
- Service establishment, management, and delivery - CMMI for Services (CMMI-SVC)
- Product and service acquisition — CMMI for Acquisition (CMMI-ACQ).

The figure 6 shows the Maturity model of CMMI:

Figure 6 CMMI – Staged, adapted from [14]

2.8. The project life cycle

Common to all models is the so called project life cycle, which is a description of the development of a virtual project. It is divided into three phases: Initiating, doing and closing. The project starts with the initiating phase. Afterwards it keeps on going with the doing phase which is composed of a loop of three parts: Planning, executing and controlling. Finally, the last phase is the closing one [16]

The Figure 7 shows the project life cycle schema:

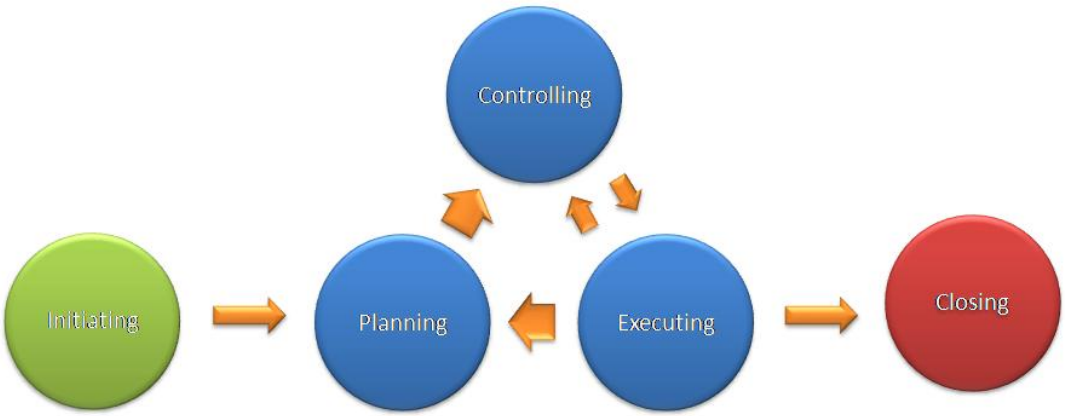


Figure 7 Project life cycle, adapted from [16]

Often project managers spend most of the time in the executing and controlling phases, but these aren´t the most important phases of the project because it is not here were the failure or success of the project gets dictated. The other three phases are clue for the success of the project. Without a proper Initiating phase the purpose of the virtual project is probably not clear to the virtual project team members and they may disagree at which point the project will be finished. In the initiating phase everybody has to get an exact idea about the project [16].

If an accurate planning doesn´t take place, afterwards it is pretty sure that there will be enormous organizationally problems like processes which won´t be able to be started because previous necessary processes still didn´t take place, resources which aren´t ready to be used when they are needed and so on. Any team member will know which step has to be done next because there is no planning. The best way for planning is to plan the project´s next steps in detail and tasks which are more far away in time on a higher level (higher level means to take first a general approach first and later a deeper planning). This is known as

the *rolling wave* approach to planning. Usually a one month planning is taking in this approach. The deliverables are broken down into small sections which are easily trackable and help to have a good control of the developing of the project. Any process which is more than one month far away keeps being unplanned in detail, only at a high level to know what is going to happen next without getting lost in the details Later, in the next chapter of this thesis, each of these phases will be explained more deeply [16].

A proper closing is also important: the learned lessons, the documentation, the deliverables, team members curriculums, stakeholders information, everything has to be stored and backed-up for further projects. It is possible that a project gets never completely closed if the Closing phase gets neglected. Typical cases are stakeholders who keep coming back asking for just another change or fixing a bug which was just found, because it has never been completely clear that the project is finished. Maintenance is not part of a project [16].

2.9. Project management tools

There are thousands of tools available in internet for project management. The most important about a tool is that it has to be a comfortable for all team members who have to use it, and not only because it is the best tool from the point of view of the project manager. A tool is only a good tool when it is being used. That´s why a tool has to be proposed by the project manager but chosen by all the team members. This is the only way to ensure that the tool is going to be used [16].

Part II
Similarities and differences between PM and vPM

In this part there will be shown and explained similarities and differences between PM and vPM.

3rd Chapter
Similarities between PM and vPM

Both, PM and vPM share similar characteristics. As described by the PMBOK® Guide [3], Horine [1] and Williams [16] the main phases of any project are:

- Initiating
- Planning
- Executing
- Controlling
- Closing

Each time a company starts a project it has to be divided into those phases to have a better control along the development. These phases are the *project life cycle* [16].

Each of those phases is going to be explained in the next point.

3.1. Project life cycle

The project life cycle defines the beginning and the end of a project. For example when an organization identifies an opportunity to which it would like to respond it will often authorize a needs assessment and/or a feasibility study to decide if it should undertake a project. The project life cycle definition will determine whether the feasibility study is treated as the first project phase or as a separate standalone project [16].

The project life cycle definition will also determine which transitional actions at the beginning and the end of the project are included and which are not. In this manner the project life cycle definition can be used to link the project to the ongoing operations of the performing organization [16].

The phase sequence defined by most project life cycles generally involves some form of technology transfer or handoff such as

requirements to design construction to operations, or design to manufacturing. Deliverables from the preceding phase are usually approved before work starts on the next phase. However, sometimes when the risks involved are deemed acceptable, a subsequent phase starts before the deliverables of the previous phase are approved. This practice of overlapping phases is often called fast tracking [16].

Project life cycles generally define: What technical work should be done in each phase (e.g., is the work of the archiver: part of the definition phase or part of the execution phase?). Who should be involved in each phase (e.g. implementers who need to be involved with requirements and design). There are five phases to the TPM (Traditional Project Management) life cycle, each of which contains five steps [16]:

- Scope the project
  State the problem/opportunity. Establish the project goal. Define the project objectives. Identify the success criteria. List assumptions, risks, and obstacles.

- Develop the project plan
  Identify project activities. Estimate activity duration. Determine resource requirements. Construct/analyze the project network. Prepare the project proposal.

- Launch the plan
  Recruit and organize the project team. Establish team operating rules. Level the project resources. Schedule work packages. Document work packages.

- Monitor/control project progress
  Establish progress reporting system. Install change control tools/process. Define problem-escalation process.

- Monitor project progress versus plan
  Revise project plans. Close out the project. Obtain client acceptance. Install project deliverables. Complete project documentation. Complete post-implementation audit. Issue the final project report.

3.2. Initiating

For Williams [16] the initiating phase is the most important because it may be crucial for the successful finishing of the project. In this phase is were the project gets defined in a contract. There will be two contracts. The formal one called project charter and reflects all the issues of the project. The informal one in which the project manager will explain the details of what is going to be delivered and the needs and wishes of

the customer, topics which may be difficult to be reflected in a formal contract [16].

It happens more often than expected that the customers walk away with a different idea than the project manager of what the deliverables of the project are going to be. This is the most dangerous part of this phase because it will lead to severe problems or even to the failure of the project and it has to be avoided by all means. A clear exposure of the ideas from both parts is extremely important to avoid problems [16].

3.2.1. The Project Charter

Once the company has been asked for a possible project, a feasibility study gets ordered, which has to be positive to keep on working with the project. The next step is to specify the characteristics of the project, the expected results, the available budget and the desired deadline. All these points are part of the project charter which is essential to ensure user involvement and understanding, particularly because the charter must document the agreement between the project sponsor and the project manager, provide a clear statement of the purpose of the project and what is to be delivered by it and define the project roles and responsibilities [10].

A project charter is the blueprint of a project; it constitutes the foundations upon which the project will proceed. If the project charter does not achieve the objectives stated above, then the project will most probably fail, simply because the criteria for success are not described accurately and there is no common understanding of what constitutes success. The project charter is not a static document. It needs to be updated as, if and when the project scope changes, when staff assigned to the project change, when stakeholders change, when budget variances occur, etc. The project manager must treat the project charter seriously and make all efforts to achieve the commitments reflected in it [5].

In the project charter should be reflected [16]:

- the objectives of the project, where an overall description of the project should be including the key areas and the benefits. All the parts should be clear, specific and measurable to make clear if a feature has been done or not
- the reasons to do the project, a brief explanation
- the most important deliverables, a high level description of the processes involved to do the deliverables and how many time are these going to last.

- who is going to be implied in the project, a short description of who or which teams are going to do which task, depending on the size of the project.

- the deadline, an estimation of the time where the deliverables will be ready should be exposed here.

It has to be clear that a project charter is not a contract. It should be held as short as possible. This will make it easier for all the stakeholders and implied parts to read and understand the project charter, avoiding as much as possible future problems derived from misunderstandings or unaccomplished expectations. The project charter is an important document all over the development of the project and not just in the initiating phase. If important decisions which may affect the scope of the project have to be taken, referencing to the project charter will be of a great value [16].

The project manager has to have a formal contract. Sometimes in big companies with internal projects, there are no special contracts. Then the project charter becomes really important to clarify which where the expectations and obligations of the project manager [16].

The most important points for the initiating phase are [16]:

- What are the reasons to do this project

- Which are going to be the deliverables

- How should the deliverables be

- Who is going to be implied

- The deadline to deliver the deliverables

The next steps should be followed [16]:

- Write down the most important information about the project like the business needs, objectives, deliverables, deadline and who is going to be implied into the project charter.

- Hold a meeting with the most important stakeholders to discuss all the topics reflected in the project charter and ensure that everybody agrees with these topics.

- Have a kick-off meeting to inform everybody about the characteristics and expectations of the project. Later will be

explained more deeply how the kick-off meeting should be.

For a virtual project sometimes it could be extremely difficult to arrange face to face meetings (kick-off or stakeholders meeting). In these cases try to have at least a videoconference meeting. More information in Chapter 4 at the point 4.4.1.

3.3. Planning

An appropriate planning is very important because it will avoid unexpected problems in the development of the project. There are several reasons for good planning. It helps to understand the project better. The project can be divided into its main parts showing up the needs of each part and what needs to be delivered to whom. It will be easier to see what needs to be completed before another task should start [16].

Planning is important to realize how the issues should be treated. Problems can be foreseen and thus allowing to know what has to be done to avoid or minimize the problem [16].

Delivering accurate information about the development of the project to the team members as well as to the customer has to be planned. Knowing the problems and the needs of the project makes it easier to estimate when a task is going to be finished and when another task is going to be started [16]
.
Planning helps to keep the project under control. Knowing possible problems before these are going to happen, estimating when tasks are going to be finished or started helps to keep the control of the project. This helps also to check if the project is developing as expected and make some changes if necessary before it becomes too late. It is also useful to know which is going to be the next step to do to have a good work rhythm [16].

Planning a project for the first time is a six-steps process [16]:

1. Divide the project deliverables into small parts easy to work with
2. Identifying dependencies
3. Estimating the time a task is going to take
4. Adding contingency
5. Risk management
6. Plan presentation to the team members

Each part is going to be explained briefly in the next .

3.3.1. The Deliverables

The deliverables are the ending products of the project. These could be tangible like machines, objects or intangibles like software, a brand identity and so on. Sometimes is not easy to see the deliverables resulting of a task, therefore the focus has to be held on the end product. The deliverables have to be small enough to be achievable and measurable. This way it's easier to control the development of the whole project [16].

3.3.2. Identifying dependencies

At this point it is important to identify which deliverables depend from other deliverables, which is called dependency between tasks. There two kinds of dependencies: resource dependency and true dependency[16].

When people work alone, they have to plan all the tasks sequentially because they cannot perform two different tasks at the same time. This is called *resource dependency*. When a project manager has to plan the performing of the tasks, it is very easy to make the mistake of planning a sequential performing order of the tasks, as if only one worker could work at the same time [16].

The project manager has to identify which tasks depend from one or several tasks which have to be done necessarily before. This is called *true dependency*. All the other tasks should be planned to be done at the same time, as far as possible, depending on the human resources, which saves a lot of time [16].

This saving of time is an important point of virtual projects. The time differences allows the virtual project manager to plan the tasks to do, in the best case, in an almost non-stop rhythm (24 hours a day) taking profit of the time differences between teams. When one team member finishes his daily working time, the task he was doing should be delivered to another team member who is going to start his working time.

3.3.3. Estimating the time a task is going to take

The project manager has to estimate how many time a task is going to last. Depending on this estimation the virtual project manager will build up a schedule. Ideally the team member who is going to do the task should do the estimation. If more than one person is going to do the work, then this team needs to agree an estimate together. This involvement of the workers into the task they are going to do, will help them to make an accurate estimation and be aware of the importance of this estimate. Estimations have to be realistic, otherwise the schedule will be a failure from the beginning. The experience of the team workers in similar tasks will be extremely helpful to make a realistic estimate. If it is the first time that they face a task like that, an accurate estimate will be

extremely difficult. In such a case the best practice is to break down the tasks into smaller tasks. These will be easier to be estimated. A second practice is the using of averaging techniques [16].

- $$\frac{(\text{Most optimistic} + \text{least optimistic})}{2}$$
  This is just a normal average calculation from the longest and shortest estimate

- $$\frac{[\text{ Most optimistic} + (4 \text{ x most likely}) + \text{least optimistic}]}{6}$$
  This method gives more importance to the most likely estimate for the project manager

Once the project manager has got the estimates, he has to evaluate them according to his experience. All the estimates have to have a founded base and not be just guessing [16].

It is very difficult to make appropriate estimates from tasks which have to be done in more than six to eight weeks from the moment the estimation is going to be done. Usually projects are divided into phases which last around three months. The actual phase has to be accurately estimated getting into the details as much as possible. The next phase has no sense right to be estimated until short before its starts[16].

A role wave approach helps to get a general estimation, which has to be more accurate the closer the start of the next phase will be. Explaining to the customer and stakeholders that long term estimations are just rough estimations but short term estimations are pretty accurate avoids many questions about the next phases. This gives also a support to the team members because this way they realize the importance of their short term estimates [16].

3.3.4. Adding contingency

Even with the best estimates, it is always possible that something unexpected demands some extra time. Contingency is how this extra time is called and has to be taken in consideration in the schedule for unexpected situations. These situations could be tasks which take longer than expected, public holidays or other situations which delay the rhythm of work. Stakeholders have to be warned as soon as possible about a contingency because they expect predictability, this means, en exact schedule which is going to be accomplished on time. It is important to identify inherent contingency, which arise when one task relies on another one and there is a gap of time in between both [16].

3.3.5. Risk management

Risk management is one of the main topics in project management. There exists an extensive bibliography about this topic like [20]. Risk management is about all the issues which may happen along the development of a virtual project. The project manager should write a list with all possible risks in the project. Afterwards, these risks should be classified. An example of a classification could be to rate risk in low, medium or high level. The kind of classification is completely up to the project manager. One classification could be the possibility that a risk takes place and then a second classification would rate the severity of the risk. The sum of both classifications would be the final rate of the risk. This rate will help to decide which risk is going to be prevented first [16].

Risk is defined by ISO31000 [17] as the effect of uncertainty (positive or negative) on objectives. Risk management tries to identify and classify the priority of risks. The PMI at its PMBoK Guide [3] defines risk management as the systematic process of identifying, analyzing, and responding to project risks. It includes the maximization of the positive events and the minimization of negative events.

The procedure of creating a risk management plan is composed by 6 processes [3]:

- Risk management planning.
- Risk identification.
- Qualitative risk analysis.
  Classification of the risks depending on their severity.
- Quantitative risk analysis.
  Choosing which risks have to be prevented.
- Risk response planning.
- Risk monitoring and control planning.
  Describes how to face these risks.

Each of these processes interacts with the others and affects the whole project. These processes use to overlap each other. Project risk includes both, threats to the projects objectives and opportunities to improve on those objectives [3].

There are two kinds of risks [3]:

- Known risks: these risks have been identified and analyzed and it is possible to prevent or plan them.

- Unknown risks: these risks cannot be foreseen and planned. The project managers use to apply general contingency measures in these cases.

Each of the previous mentioned processes is going to be explained following the model exposed in the PMBoK [3], which describes for each process three stages: input, tools and output. This model allows to see easily which are the issues which have a crucial influence into each kind of risk (the inputs), how to face them (the tools and techniques) and what is the expected result (the output) [3].

Risk management planning
This is the process of deciding how to face and prevent the risk management activities for a project and is depicted in figure 8.

The **inputs** for the risk management planning are [3]:

- The project charter (see 3.2.1, Chapter 3).

- The organizations risk management policies.
  Some organizations have already a structured way to approach and face risks, and the project management has to care about these procedures. Sometimes templates have been developed in the organization to show the risks that are going to be prevented.

- Defined roles and responsibilities.
  The already in the project charter defined roles and responsibilities play an important role in the risk management planning.

- Stakeholder risk tolerances.
  The tolerance limit that the stakeholders are willing or able to held.

- *The Work breakdown structure* (WBS).
  WBS is a graphical representation of the scope of the project, showing the most important aspects of the project (see point 3.3.10, Chapter 3).

The **tools and techniques** are planning meetings in which all the key members of the project (project manager, stakeholders, project team leaders and anybody who is somehow responsible for planning risks) take part and develop the management plan, using organizations templates if needed [3].

The **outputs** are: The risk management plan which describes how risks have to be identified, classified and faced if necessary. In this plan may be included issues like [3]:

- Methodology.
  There must be defined how the risks have to be identified, the tools as well as the data sources that have to be used for the planning.
- Roles and responsibilities.
  Each kind of problem has to be faced by a team and its leader.
- The budget for facing the risks has to be included here.
- Timing.
  It specifies how often has to be done the risk management along the project development.
- Classification of risks.
  It sorts the qualitative and quantitative level of the risks.
- Report.
  The format of the report will be specified here, as well as how it has to be structured.
- Tracking.
  It specifies how risks activities have to be tracked and solved if necessary.

The figure 8 shows the risk management planning process.

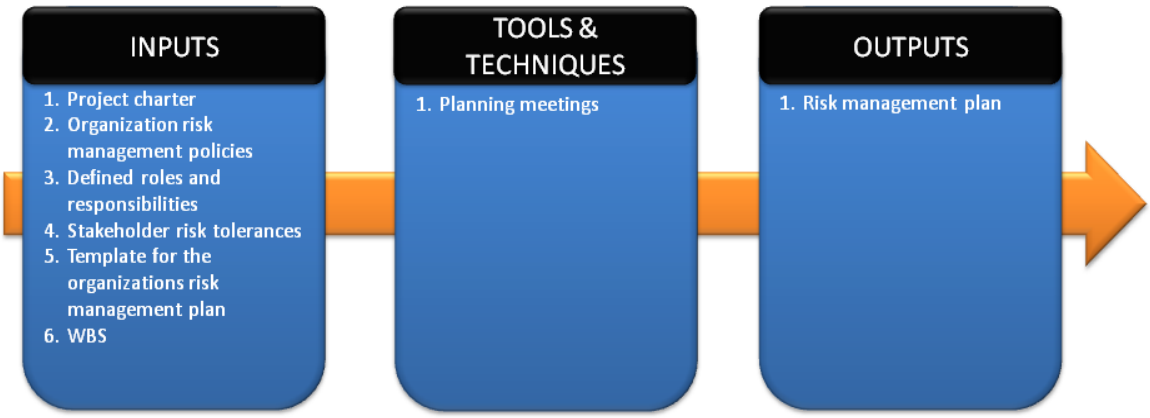


Figure 8: Risk Management Planning, adapted from [3]

Risk identification
This process identifies the risk that may appear along the project life cycle.

The **inputs** are [3]:

- The risk management plan, which is the output from the previous process.

- The project planning outputs.
  The understanding of the scope of the project as well as the objectives of the owner, the sponsor and stakeholders is very important for risk identification. The outputs of other processes should be carefully analyzed and supervised to identify possible risks. Processes like WBS, project charter schedules, product description among others should be analyzed and supervised.

- Risk classification categories.
  The risks should be identified and categorized. Each category deserves a different approach in the solution of the risk. Some risk categories are [3]:

  - External risks.
    Labor issues or legal problems are external risks. Natural catastrophes or political instabilities require disaster recovery instead of risk management.

  - Organizational risks.
    Cost, hierarchical conflicts, time and/or scope of the project changing, inconsistency of objectives among others risks fall into this category.

  - Technical risks.
    Unproven technologies, changes of the technology or standards of the industry during the project life cycle.

  - Project management risks.
    Poor allocation of time, bad use of project management disciplines among others.

  - Information of previous projects like published projects or prior internal projects of the organization may help to identify risks which already happened and their solutions.

The **tools and techniques** are [3]:

- Documentation reviews.
  All the planning should be reviewed and checked again to prevent any undetected risk.

- Information-gathering techniques.
  Brainstorms are a good example of information gathering techniques as well as *SWOT*[4] analysis (SWOT = Strengths, Weakness, Opportunities and Threats) to detect weaknesses in the project and therefore possible risks by examining the project from each of the SWOT perspectives, interviews to experienced and skilled workers and project managers, the *delphi technique*[5] in which a consensus between experts in a topic is sought.

- Checklists for risks identification.
  Should be elaborated from the information from previous projects or the experience of the workers and the project manager as well as from other sources of information. Checklists are limited to the information provided by the project members and their expertise, but they could be incomplete and therefore the project manager shouldn´t rely only on the checklist listed risks.

- Diagramming techniques.
  There are several diagrams which help to identify some risks. These diagrams are:

  - Cause and effect diagrams which help to identify the cause of the risks.

  - System or process flow charts which shows the interrelation of elements or processes and possible risk sources.

  - Influence diagrams which show what has had an influence in a given problem as well as the time order these influences showed up.

- Assumption analysis is a technique which analyzes the validity of the assumptions taken to plan the project.

The **outputs** are [3]:

- The risks that have been identified.

[4] http://www.quickmba.com/strategy/swot/
[5] http://www.learn-usa.com/transformation_process/acf001.htm

- The triggers, also called warning signs or symptoms which indicate that a risk is about to occur.

- Inputs to other processes.

Figure 9 shows the process of Risk identification.

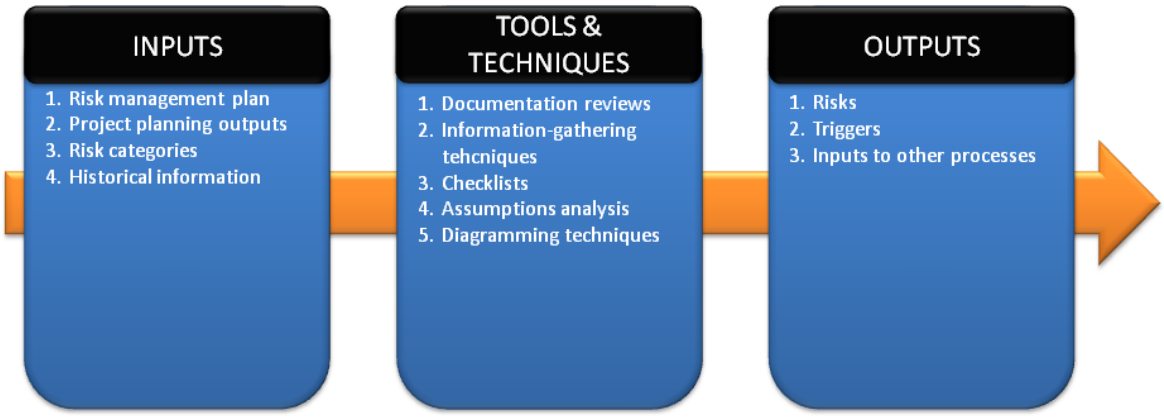


Figure 9: Risk identification, adapted from [3]

Qualitative risk analysis
This process analyzes the importance or impact of identified risks as well as the probability that these risks happen. Qualitative-analysis methods and tools are available and have to be used by the project manager to perform a qualitative risk analysis. This analysis should be performed again along the project life cycle to be aware of possible changes and therefore new risks [3].

The **inputs** of Qualitative risks analysis are [3]:

- The risk management plan.

- The identified risks.
  The risks identified in the previous process will be evaluated and classified in this process.

- Project status.
  That a risk happens depends on which stage of the project is being developed at that moment.
- Project type.

Often used types of projects use to have the same risks; new types of projects have unexpected risks that have to be analyzed.

- Data precision.
  The precision describes how well a risk is known and understood as well as the quantity and reliability of the available data.

- Scales of probability and impact.
  These two scales will be used to evaluate the importance of a given risk.

- Assumptions.
  The assumptions identified in the previous process are considered as risks.

The **tools and techniques** for qualitative risk analysis are [3]:

- Risk probability and impact.
  This tool quantifies the possibility that a risk happens (probability) and in case that it happens how strong will be the effects (impact). The risk probability and the risk impact classification should be: very low, low, medium, high and very high.

- Probability/impact risk rating matrix.
  A matrix should be constructed combining the risk probability with impact of the risk and the result would be a rating: very low, low, medium, high and very high. If the probability that a risk happens is high and the impact is also high, further analysis should be devoted to the prevention of this risk.

- Project assumption testing.
  Identified assumptions which were taking along the project have to be tested and treated as potential risks.

- Data precision ranking.
  Accurate data are necessary to perform a good qualitative risk analysis. Data precision ranking evaluates how useful are the data provided for the risk management. Following aspects must be considered: How well has the risk been understood, how many data are available for this risk, how accurate and reliable are they?

The **outputs** of qualitative risk analysis are [3]:

- An overall risk rating of the project.
  This rating helps to decide how to treat the risk and how much money has to be invested in the solution.

- List of prioritized risks.
  Risks are classified by different criteria. Some of them have to be managed immediately, other doesn´t have to be managed that fast.

- List of risks for additional analysis and management.
  The risks with the highest classifications must be in this list in order to analyze them and to try to find a solution, in other words, to be properly prepared if this risk happens.

- Trends in qualitative risk analysis results.
  The analysis has to be done several times along the project life cycle. The same risks appear from time to time (maybe new ones also meanwhile others disappear), which helps to evaluate the tendencies of these risks and do a prognostic.

Figure 10 shows the process qualitative risk management.

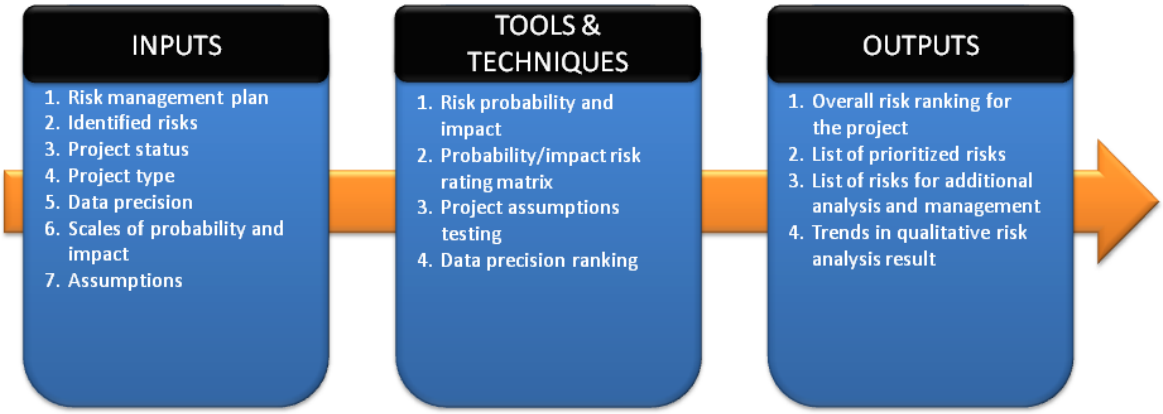


Figure 10: The Qualitative risk analysis, adapted from [3]

Quantitative risk analysis
This process calculates numerically the probability that a risk happens and the impact it may have on the project. This process aims to calculate the costs of the consequences of a risk as well as the cost of the measures to take to prevent or avoid the risk, to calculate the probability of achieving a specific project objective, the risk exposure of the project and the cost and size of the schedule contingency that may be needed[3].

To perform a quantitative risk analysis previously it has to be done a risk identification as well as a qualitative risk analysis[3].

The **inputs** of the quantitative risk analysis are [3]:

- The risk management plan.

- Information of previous projects.
  The information about previous risks as well as the measures taken, stored in data bases will be extremely helpful. Other sources from other companies or the industry will also be welcome.

- Expert judgment.
  The previous experience of some team members as well as external experts will also be helpful for the qualitative risk analysis.

- Other planning outputs.
  The most useful planning outputs are the time and cost estimation used to plan the project.

The **tools and techniques** of the Quantitative risk analysis are [3]:

- Interviewing.
  To interview somebody related to the project (e.g. a stakeholder) helps to quantify the probability that a risk takes place and the consequences of this risk for the project objectives. Different probabilistic analysis will be taken on the data acquired along the interviews.

- Sensitive analysis.
  This kind of analysis helps to find out which are the risks with the highest impact for the project objectives.

- Decision tree analysis. This analysis is represented as a decision tree. It shows the implication of a decision related

to a risk and its development. The tree shows most of the possible decisions to take about a risk and the implication of these decisions for the development of the project.

- Simulation. Through several statistical methods like the Monte Carlo technique the impact of the risks on the objectives of the project become clear.

The **outputs** of the quantitative risk analysis are [3]:

- Prioritized list of quantified risks.
  The most relevant risks are listed here. The relevancy of a risk depends on how high is the impact and the probability that this risk happens for the objectives of the project.

- Probabilistic analysis of the project.
  This analysis makes a forecast for a project schedule and costs of the project.

- Probability of achieving the cost and time objectives.
  The quantitative risk analysis helps to figure out what is the probability of finishing the project at the expected deadline and respecting the budget according to the actual plan and knowledge of risk.

- Trends in quantitative risk analysis results.
  By repeating the analysis several times, a trend of results may become apparent.

Figure 11 shows the quantitative risk analysis process.

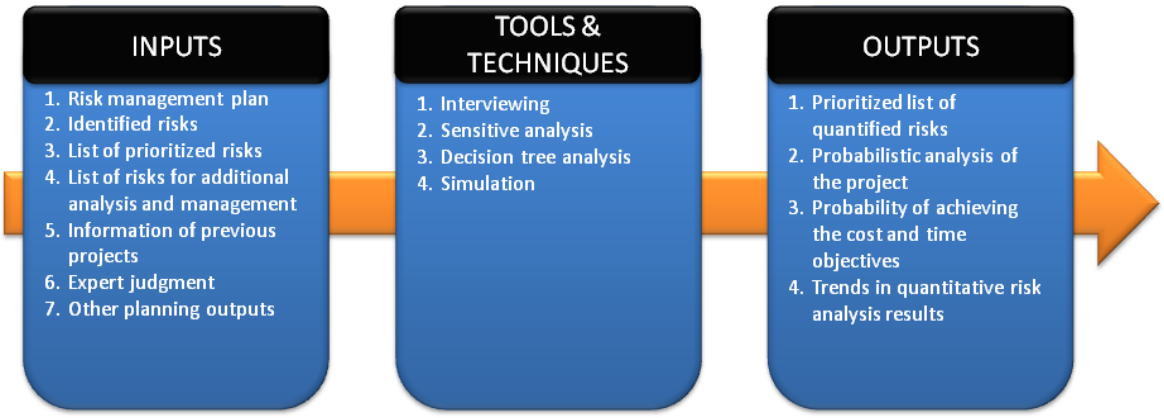


Figure 11: Quantitative analysis process, adapted from [3]

Risk response planning
This process helps to develop options and actions that reduce the impact of the risk and therefore the risk of failure of the project. Each of the responses to a risk has to be assigned to a team or a team member who becomes responsible of the appliance of the planned measures if the risk takes place [3].
The response to the risk has to be accurately planned and adapted to the importance of the risk, be rapidly applied, all the parts have to agree the response and somebody has to be responsible of applying the measures if necessary [3].

The **inputs** of the risk response planning are [3]:

- The risk management plan, the list of prioritized risks, the risk ranking of the project, the prioritized list of quantified risks, the probabilistic analysis of the project and the probability of achieving the cost and time objectives have already been explained in previous sections.

- List of potential responses.
  To the identified risks there will be also a correspondent list of responses.

- Risk thresholds.
  There is a level of tolerance in the risks which is acceptable. Once this level has been surpassed an action has to take place.

- Risk owners.
  This is a list of stakeholders which may act as owners of the responses to a concrete risk. They should also be involved in the development of the responses to the risks.

- Common risk causes.
  Sometimes it may happen that several risks have the same origin. A response to avoid this origin will prevent that several risks happen.

The **tools and techniques** of the risk response planning should be effective and specific for each risk. Some of these tools are [3]:

- Avoidance.
  By changing the plan of the project it is possible to avoid that a risk may happen or at least lowers its impact. Some examples of avoidance are using known approaches

instead of new ones, adding time or resources, not working with unknown stakeholders or subcontractor among others.

- Transference.
  This tool passes or transfers the risk from one owner to another one, who maybe is more familiar to this kind of risks and the needed response. Usually the new owner agrees to get the risk if he gets paid for it.

- Mitigation.
  This tool tries to reduce the impact of the risk. It is better to prevent that a risk happens instead of trying to fix the consequences of the risk after it happened. Using less complex processes, making more tests, looking for a stable seller among others are mitigation actions.

- Acceptance.
  When the team gets to a point where no further response to a risk is found, or no response at all or changing the project plan doesn´t help to avoid the risk; accepting these facts and dealing with the risk when it occurs is called acceptance and sometimes the only solution possible. Active acceptance happens when some plan or strategy is still possible to be conceived in case the risk happens. Passive acceptance is not changing anything until the risky issue happens and then try to deal with its effects.

The **outputs** of the risk response planning are [3]:

- Risk response plan, which should describe in detail how the actions will be taken. Following should be included:

  - The description of the identified risks as well as which areas of the project would be affected by this risk and how would it affect the objective of the project.

  - The risk response owner and the assigned responsibilities.

  - The budget and time needed for the responses.

  - The actions needed to apply a response to a risk.

  - Results from the several analysis processes (quantitative and qualitative analysis).

  - The agreed responses to the specific risks.
  - The level of residual risk remaining after the response has taken place.

  - Contingency and fallback plans

- Residual risks
  These risks remain after the application of the planned measures for a risk.

- Secondary risks
  Are the risks which appear due to the application of the planned measures. These risks should be identified and responses to these risks should be planned.

- Contractual agreements.
  These agreements specify the responsibility for specific risks of each party´s of the project.

- Contingency reserve amount needed.
  The risk threshold and the probabilistic analysis help to determine the amount of contingency needed to accomplish the projects objectives or to keep the risk at an admissible level to accomplish the project objectives.

- Inputs other processes.
  The response to risks implies most of the time an increasing of the time, costs or resources and changing the project plan. The company or organization has to be sure that it is worth the spending according to the level of the risk reduction.

- Inputs to a revised project plan.
  The outgoing of the response planning has to be integrated in the project plan to be sure that the actions to reduce the risks impact will be performed.

Figure 12 shows the Risk response planning process

Figure 12: Risk response planning process, adapted from [3]

Risk monitoring and control

This process tracks the identified risks, monitors residual risks and identifies new risks. It ensures the risk plans execution and evaluates the effectiveness of these plans. This plan is applied along the development of the project. This process provides information of the risks before these may happen in order that the project manager can take effective decisions. The stakeholders must be informed periodically to make sure that they agree to the level of risk of the project. The purpose of the risk monitoring and control process is to determine if [3]:

- Risk responses have been implemented as expected.
- Risk responses are effective or if new responses should be planned.
- Project assumptions are still valid.
- Risk danger has diminished, a trend analysis must be included.
- Adequate policies and measures are applied.
- New risks have appeared or older risks have increased.
- A risk trigger has happened.

Risk control may change the project plan, develop new risk responses, look for alternative strategies, add contingency to the plan among other measures. The risk response owner should report periodically to the project manager if the responses are effectively applied or if new responses should be planned to minimize the risk[3].

The **inputs** of risk monitoring and control are [3]:

- The risk management plan and the risk response plan.

- Project communication.
  Information about the project performance and risks are supplied by other project records. Following reports are used to monitor risks: Issues logs, Action-item lists, Escalation notices or jeopardy warnings.

- Additional risk identification and analysis.
  Potential not previously identified risks may appear all of a sudden when the project performance is measured and reported. For these risks should be these six risk processes implemented.

- Scope changes.
  If the scope of the project is changed, often new risk analysis as well as risk responses are necessary.

The **tools and techniques** of risk monitoring and control are [3]:

- Project risk response audits.
  Along the whole project risk auditors are checking if the risk responses are properly implemented and their effectiveness in avoiding or minimizing the risk impact as well as the effectiveness from the risk owner.

- Periodic project risk reviews.
  This process should be regularly scheduled along the project. In every team meeting project risks should be a point to be discussed or at least checked. The risk rates or priority may change along the project development which may demands additional qualitative or quantitative analysis.

- Earned value analysis.
  This kind of analysis is used to evaluate if the actual process status compared to a baseline plan indicates a

potential deviation in costs or schedule targets of the project by finishing it. If a significant deviation is detected, updated risk identification and analysis should be done.

- Technical performance measurement.
  This process compares the technical accomplishments with the planned ones. Deviations of the plans should be considered a risk.

- Additional risk response planning.
  If there appears a risk which wasn´t planned or the impact of a risk is bigger than expected, additional response planning will be necessary to be performed to control the risk.

The **outputs** of risk monitoring and control are [3]:

- Workaround plans.
  Workarounds are unplanned responses to unexpected or unidentified risks. These responses have to be documented and incorporated to the project plan.

- Corrective action.
  A workaround or an application of a contingency is a corrective action.

- Project change requests.
  If a contingency or a workaround have to be applied, a change in the project plan has also to be done.

- Update to the risk response plan.
  All the risks of the project, whether they happen or not should be documented. The ones which happen should be also documented as well as the effectiveness of the response.

- Risk database.
  All the risks, the fact that they happened or not, their frequency, the planned responses and the effectiveness of the responses should be documented for further projects.

- Update to risk identification checklists.
  Checklists updated from the experience of the actual project will be helpful for future projects.

Figure 13 shows the Risk monitoring and control process.

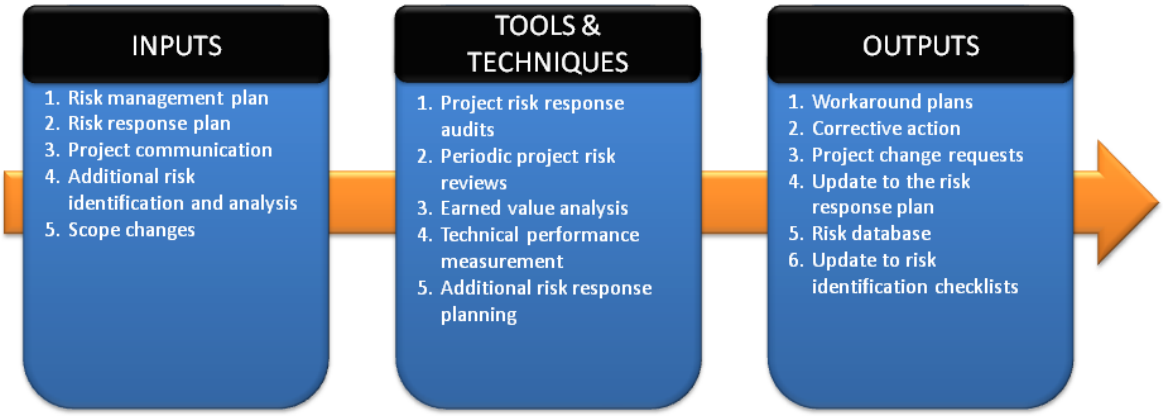


Figure 13 Risk monitoring and control process, adapted from [3]

3.3.6. Deliverance of the plan to the team members

The team members have to get a specific plan in which everything that has to be delivered to the customers and the steps which will make it possible have to be specified. A schedule which describes the estimated time where specific goals must be reached, the risk management plan as well as the assumptions and restrictions valid for the project must also be included in the plan. All the team members have to have the plan [16].

Once the project manager gets the project charter, the planning phase of the project starts. Along this phase following has to be prepared by him [16]:

- *Team* building
- The methodology and *tools* have to be set
- *Kick-off meeting* has to be prepared
- The *stakeholders* have to be contacted

3.3.7. Team building

Meanwhile the project is being planned and before it gets approved, the possible team members should already be contacted to ask for their availableness to join the project. The team members should get enough information about the goals, deadline and major issues of the project. They should also know what work is going to be expected from them and who are they going to be working with, as well as their role in the team. The expected duration of the project is also an important point [4].

Once the plan has been approved, the team members should be contacted again to ensure that they are still available or to look for a substitute. They should also know when the project is going to start. Each of the team members should get a written description of the activities it has to perform [4].

Just assigning people to tasks doesn't create a project team. Portny says: "A team is a collection of people who are committed to common goals and who depend on one another to do their jobs. Project teams consist of members who can and must make a valuable and unique contribution to the project" [4, Page 226].

The team members have to know [4]:

- Goals
  the goals of the team and of the project

- Roles
  the role and position of each member inside the team, authority and assignments

- Processes
  the techniques and tools the team members will use to do their tasks.

- Relationships: how is the relationship between the team members.

Within one company the amount of experts available to work in a project is limited. In a virtual project, the project manager has the possibility to contact with experts all over the world. He can use social networks like Xing[6] or Linkedin[7] to get in touch with these high skilled experts.

3.3.8. Methodology and tools

The Project manager has to take many decisions for the project. All these decisions are important but probably the decisions about the methodology as well as the tools which are going to be used are crucial. But a tool is only useful if everybody is able and willing to use it [10].

In the kick-off meeting, the virtual project manager should present a set of tools which will be used along the development of the project. It is necessary that the team members agree to use these tools. It is important that they feel comfortable using them because these tools have to help them instead of being another hurdle in

[6] https://www.xing.com/
[7] http://www.linkedin.com/

the developing of their tasks. These tools could be communication tools (like videoconference, chat, e-mailing and so on), back-up tools, controlling among others [10].

In the same meeting the virtual project manager should also introduce the methodology (e.g. PRINCE2[8], HERMES[9]) which is going to be implemented for the development of the project. Being known methods makes the work easier for all the team members, because these methodologies have clear lines how processes should be carried out. This way, everybody knows how a report should be done, where should it be stored, when should the back-ups take place and how, and so on. This makes it also easier for the project manager because he knows where to find what he is looking for [10].

3.3.9. Kick-off meeting

The team members as well as the interested stakeholders have to attend the kick-off meeting. In this meeting probably everybody will meet each other for the first time for the project. At this meeting several points have to be explained or set by the project manager, meanwhile other points have to be decided by commitment. It is also an important point to use the kick-off meeting to get everybody (team members as well as stakeholders) involved in the project, so they will care more to finish it with success. A typical kick-off meeting should include [1][16]:

- Welcome and introduction to the reasons of the project.
- An explanation of the project charter to expose the main points of the project.
- A schedule and communications plan so that everybody knows what is going to happen next.
- The tools which are going to be used for communication have to be set by commitment between the project manager and the team members. These have to feel confident with the tools which are going to be used for e-mails, chat and videoconference.

[8] http://www.prince2.com/
[9] http://www.hermes.admin.ch/

- Rules have to be established and agreed also by commitment. These rules have to set procedures like who informs whom and when, schedules which set how often reports have to be done, where have the reports to be stored as well as the tasks already done, who has to be aware of which reports, who is in charge of what and so on.

- The roles of the team members have to be set clearly to avoid further problems and misunderstandings.

- The characteristics of the project have to be explained clearly: the goal, the deadline, milestones so that everybody has a clear idea why something has to be done and how fast.

- The distribution of the teams and team members.
  Which work is going to be done by each team member and each team.

- Schedules for reporting, meetings, briefings have to be set

- Setting of standards.
  Many team workers will be doing similar jobs and therefore it is important that they follow some standards in order that their work is going to be compatible and working with each other.

- Do several Kick-off meetings along the project to make sure that everything is developing as expected or to communicate new milestones or changes in the scope of the project, or the introduction of new team members and so on.

3.3.10. Recommended tools

Some useful planning tools on the market are:

1. Work Breakdown Structure (WBS)
   WBS is a graphical representation of the scope of the project. It shows the hierarchy as well as the deliverables of the project. The WBS should show the whole project and all the deliverables. The construction of a WBS is based in breaking the overall project into component deliverable. Then breaking the deliverables again in smaller parts until the pieces become achievable and manageable. Small enough would be a deliverable which takes two to three days to be done [16].

The representation of the WBS hierarchal graphs can be done with programs like PowerPoint[10], Visio[11], Omnigraffle[12] or similar [16].

The figure 14 is an example of a WBS for occupying a vacancy.

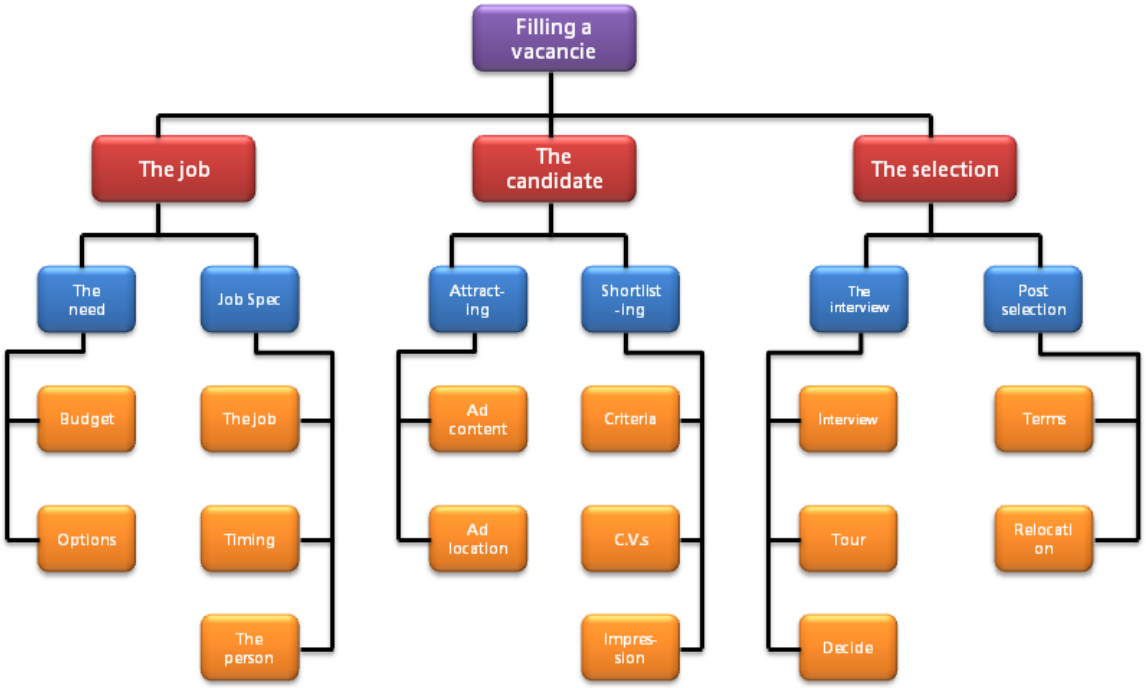


Figure 14 WBS example, adapted from [21]

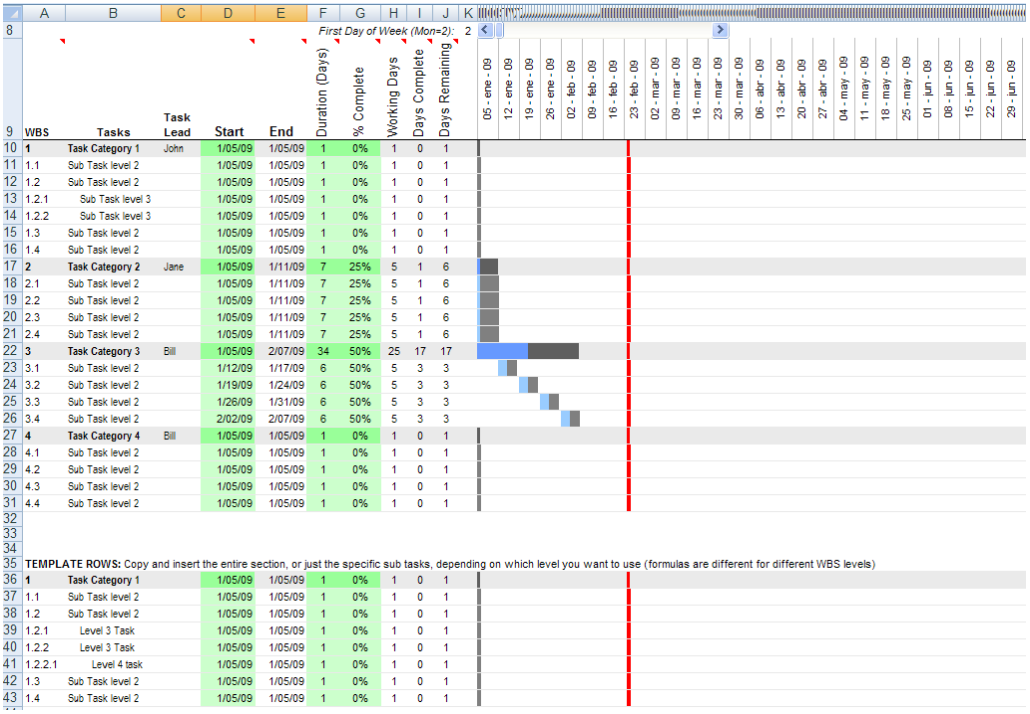
2. Gantt Chart

The Gantt chart shows the project schedule with some bars. This way it is more intuitive to see how the different tasks overlay each other [16].

On the left side there use to be listed the tasks of the project, on the right side there is a calendar in which the tasks are represented with bars. This makes it easier to see when starts or finishes a task and if it overlays another task. For Williams[16] it is more important to plan deliverables instead of tasks, but the Gantt chart shows when will be worked the deliverables [16].

[10] http://office.microsoft.com/en-us/powerpoint/
[11] http://office.microsoft.com/en-us/visio/
[12] http://www.omnigroup.com/products/omnigraffle/

Figure 15 shows a Gantt Chart extracted from an Excel spreadsheet:



WBS	Tasks	Task Lead	Start	End	Duration (Days)	% Complete	Working Days	Days Complete	Days Remaining
1	**Task Category 1**	John	1/05/09	1/05/09	1	0%	1	0	1
1.1	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
1.2	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
1.2.1	Sub Task level 3		1/05/09	1/05/09	1	0%	1	0	1
1.2.2	Sub Task level 3		1/05/09	1/05/09	1	0%	1	0	1
1.3	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
1.4	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
2	**Task Category 2**	Jane	1/05/09	1/11/09	7	25%	5	1	6
2.1	Sub Task level 2		1/05/09	1/11/09	7	25%	5	1	6
2.2	Sub Task level 2		1/05/09	1/11/09	7	25%	5	1	6
2.3	Sub Task level 2		1/05/09	1/11/09	7	25%	5	1	6
2.4	Sub Task level 2		1/05/09	1/11/09	7	25%	5	1	6
3	**Task Category 3**	Bill	1/05/09	2/07/09	34	50%	25	17	17
3.1	Sub Task level 2		1/12/09	1/17/09	6	50%	5	3	3
3.2	Sub Task level 2		1/19/09	1/24/09	6	50%	5	3	3
3.3	Sub Task level 2		1/26/09	1/31/09	6	50%	5	3	3
3.4	Sub Task level 2		2/02/09	2/07/09	6	50%	5	3	3
4	**Task Category 4**	Bill	1/05/09	1/05/09	1	0%	1	0	1
4.1	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
4.2	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
4.3	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
4.4	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1

TEMPLATE ROWS: Copy and insert the entire section, or just the specific sub tasks, depending on which level you want to use (formulas are different for different WBS levels)

1	**Task Category 1**		1/05/09	1/05/09	1	0%	1	0	1
1.1	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
1.2	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
1.2.1	Level 3 Task		1/05/09	1/05/09	1	0%	1	0	1
1.2.2	Level 3 Task		1/05/09	1/05/09	1	0%	1	0	1
1.2.2.1	Level 4 task		1/05/09	1/05/09	1	0%	1	0	1
1.3	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1
1.4	Sub Task level 2		1/05/09	1/05/09	1	0%	1	0	1

Figure 15 Gantt Chart extracted from an Excel spreadsheet

On the left side are the tasks depicted, on the right side, in the calendar and represented by bars can be seen when the tasks are going to take place [16].

The Gantt Chart can be used also to depict who is going to do which task. This way it is possible to identify who has a lot of work to do meanwhile others are barely busy. It helps to distribute better the tasks. This process is called *resource leveling* [16].

3. Plan review
   A plan review is a technique conformed from short meetings from less than 30minutes. These meetings should be tailored to each team or group of workers which have a common task. In this meeting the plan of the project should be held at a high level and only care about the details directly related to their task. These meetings help preventing confusions and following the established project plan [16].

3.4. Executing

This is the part of the project where the product is really going to be done. At this part each deliverable must have an owner. There can't be any deliverable which is not assigned to somebody who is responsible for it, even if it is going to be done in a team. This worker has to track the deliverable; checking that it is being done following the plans and, if necessary ask for help before it is too late. At the same time, if they become responsible for the deliverable, they have to have the chance to do the work on their own way. The important point is that the work is done [16].

A project plan shouldn't be a to-do list in which all the details of how a task should be done. A project plan cares about which deliverables have to be finished and not how they should be done. This is the task of the workers [16].

3.4.1. Executing tools and best practices

There are two best practices which are important for a proper development of the project:

Ownership of the work
As previously explained, there must be one worker responsible of the development of every deliverable, even if this deliverable is going to be developed in a team. This is called *ownership of the work* and helps that the workers get more involucrate into the project. This helps also that if a deliverable has to be developed in a team, they can organize themselves the best way possible [16].

Stand-up meetings
These are short meetings where each attendant has to stand up to inform briefly the others about the development of his/her work. What has been achieved and what is going to be done next as well as any important topic. These meetings could be held daily or every two or three days, but not later than that because then it is difficult to keep this meetings being short and smooth. These meetings are perfect to keep everybody up to date on the project development. It is also possible to identify overlaps of work or even workers which are too busy or not busy enough and then redistribute the work. The attendants should have the chance to write down possible to-do tasks which may come out from these meetings. It is really important that, when leaving the meeting everybody knows which are going to be their next steps to do [16].

Of course in virtual projects a stand-up meeting has no sense and should be substituted by a videoconference shifting the camera to focus each participant who can then inform briefly about the development of his/her work.

3.5. Controlling

It doesn't matter how well and accurate a project plan may have been designed, it is always possible that the project deviates from the original plan. That's the reason that controlling has to take place. Controlling is observing how the project is really developing compared to the planning and adapting to changing circumstances by applying corrective measures if necessary [16].

3.5.1. Deliverables vs. tasks

The planning was focused on deliverables and not on tasks. The tasks were delegated to the workers when the work ownership was applied. The project manager has only to care if the deliverables are finished or not and not about the tasks to accomplish a derivable. The deliverables were broken down into small parts to a level that makes it easy to know if the plan is being followed or not. This helps that if a deliverable is not on time, the project manager will know with a delay of just one or two days [16].

3.5.2. When is it done?

It is also important that the project manager and the responsible of the deliverable agree in what it means that a deliverable is "done". For instance, in programming, it could happen that the worker considers the deliverable as done when it is coded meanwhile the project manager may consider the same deliverable as done when it is coded, tested and ready to go. This could mean a big difference in the time estimation for the deliverable form the workers point of view and from the project manager point of view which could become later a hug problem, especially if this misunderstanding extends to other workers of the project [16].

3.5.3. Measuring deliverables

Measuring deliverables is the best way to be aware of the development of the project. A method which is often used is the *Earned Value Management*[13] (EVM). It measures the deliverables (earned value) finished at date with the expected ones by the plan [4].

There are three measures which are helpful for knowing how the project is developing [16]:

- How many of the planned deliverables have been delivered to date
- How much time from the planned time has already passed
- How much budget from the planned budget has been used

[13] http://www.earnedvaluemanagement.com/

3.5.4. Informing

The project manager has to decide which method to use to inform each of the stakeholders of the development of the project. It is necessary that the project manager adopts, if possible the tools the stakeholders are used to use to control their own projects or processes to be sure that there aren't any misunderstandings. There are several options, e.g. a Gantt charter (view Figure 9) in which the on time delivered deliverables where depicted in green color meanwhile the delayed ones could be depicted in red, could be a good way to inform the stakeholders [16].

To inform about the spent budget usually a depicting of the used part compared to the total amount of the budget in a pie is the best way [16].

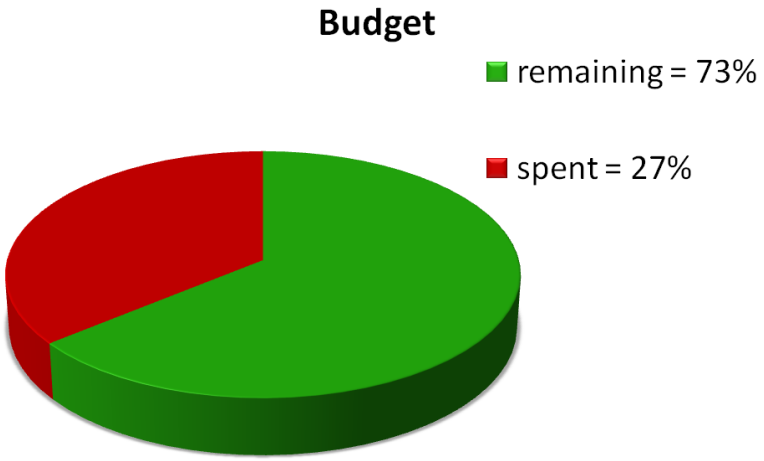


Figure 16 Example of a pie shaped budget of a project

3.5.5. From Risk to Issue

Along the planning of the project, a possible danger for the success of the project is called a risk and if it is important enough (this means that the probability of this risk to happen is high and/or if the risk happens the severity will be high) a plan to minimize its effects will be done. When along the execution of the project a risk becomes true it is called an *issue* and the plan done previously is going to be applied. This means that the current plan which was being applied has to be changed for the plan which includes this issue. Not all the risks can be detected nor are they important enough to spend time planning solutions if these risks happen to become true. If one of this risks becomes an issue, usually the team members or an experienced stakeholder will be able to help to find a fast solution [16].

If despite carefully planning a major issue takes place, the project manager has to ask for help to the project board. If the members of the project board have been picked up carefully, they will be able to take important decisions for the project like keeping on with the

project despite the extra problems (costs, time, quality…) or to stop or pause the project with also extra costs [16].

3.5.6. Verification versus Validation

Along the development of the project the project manager will be checking all the time that the teams are producing the planned deliverables. This is called *verification*. Controlling if these deliverables are what they are expected to be is called *validation*. Average project managers pay attention only to verification. They want to make sure that what is expected is going to be delivered. Great project managers pay also attention to validation. They try to deliver not only what is expected, but also what the customer really needs [16].

3.5.7. Controlling tools and best practices

Several tools will be helpful to control the project.

Listing the project issues

The issues which happened along the project development should be listed and separated from other lists like the bug list in coding for example. An issue is a problem with the project meanwhile a bug is a problem in the product. Both require different approaches to be solved. The bug is a technical problem which appeared because of a misunderstanding or a flaw in the design. A code changing usually corrects the bug.

The issue is usually less technical and depends often more from the negotiating ability from the project manager than from his technical skills to be solved. Sometimes the project board has to be consulted to solve the issue [16].

A list with several fields would be ideal to show the issues and their solution. These fields would make it easy to find the searched issue and the proposed solution as can be seen in Table 1 [16]:

#	Description	Priority	Owner	Resolution	Proj. Board consulting	Start Date	Exp. ending Date	Resolving date	Status
12	Colors not matching figures shapes	Med	Paul	Recoding flash	No	02/02/2011	06/02/2011		working
13	Missing lists	High	Mary	Looking for links	No	03/02/2011	05/02/2011	04/02/2011	DONE

Table 1: example of a list issue, adapted from [16]

Listen to the workers

A project manager should be aware of the performance of the workers and be in touch with them not only through formal meetings, but also through informal chats where people feel more comfortable to talk about their concerns or doubts about the

project development. Often the skeptic workers are the first to notice that something is not going the way it should be, but because it is just a feeling they are not keen into talking about it in formal meetings. Being actively in touch with the workers shows also interest and respect to their tasks.

Plan updating
Updating plans is advisable even if it doesn't look to be necessary. This way it is possible:

- to check how accurate the estimations were.
- to find patterns of delays and next time build in enough contingency time in the estimates to cover the incidences of these patterns.
- also to see how well the team works under time pressure.

3.6. Management skills

There are some skills a manager has to have to keep everything running in the project. These skills are mainly three [16]: Communication, Collaboration and Managing Changes.

The first of the three skills is communication which is the process of sending and receiving information between two or more parts. There are many kinds of communication depending on a variety of characteristics.

Technical point of view of a communication:

Simplex
Communication which takes place only in one direction, where somebody transmits a message to a receiver who cannot respond or interact in anyway. Examples of this kind of communication are video, audio, etc...

Duplex: Communication in both directions :

- Half duplex in which both sides can interact but only one of them each time, like sms, chats.
- Full duplex where both receivers can interact at the same time, like a telephone call, video conference, etc..

Kinds of communications point of view:

Synchronous communications, where all the participants can communicate at the same time but also all the participants have to attend the communication at the same time. Several tools are available for synchronous communication like:

- Video Conferencing: used for in-depth discussions and communications at a higher level. This kind of communication allows some level of body language (face expressions, movements which show the mood of the other part) which increases the effectiveness of the communication. The technical requirements and costs are high. There is a limited availability of video conferencing systems because it demands a huge bandwidth.

- Audio Conferencing: used for discussions with more than one counterpart. To ensure the effectiveness of the communication, the size of the group cannot be too big, otherwise it won´t be possible to understand anything. Rules have to be set, like the order of the intervention among others. A moderator on both sides of the communications would be useful. This type of communication can generate costs, depending on the size of the group and when international participation is involved.

- White boarding: used for presentation and development of ideas. The opportunity to do collaborative work is a clear advantage of this tool. However, this kind of communication may also require audio conferencing and can generate high cost and requires network-bandwidth.

- Instant Messaging: used for a type of ad-hoc and quick communication. It can be used with only one counterpart or with a group of participants. Quality of communication improves with this tool, particularly in the collaboration of international teams. It's a prerequisite that all users must use a compatible system.

- Application Sharing: used for collaborative work on documents, ideas and deliverables. However, this kind of communication may also require audio conferencing and can generate high costs and requires network-bandwidth.

Asynchronous communications, where there's a time delay in between the sending and the receiving of the message. This kind of communication may take place even in absence of the receiver.

There are also several tools for asynchronous communications available, which allow people to get the information at their convenience. This feature is especially useful if the communication takes place in between people who live in different time zones as may happen in virtual projects. Asynchronous tools are useful for sustaining dialogue and collaboration over a period of time and providing people with resources and information that are instantly accessible, day or night. In addition, asynchronous tools are helpful in capturing the history of the interactions of a group, allowing for collective knowledge to be more easily shared and distributed. The primary drawback of asynchronous technologies is that they require some discipline to use when used for ongoing communities of practice and they may feel impersonal to those who prefer higher-touch synchronous technologies. Some of these tools are:

- E-Mail Messaging
  Used for one-to-one and one-to-many communications. Can be used with different types of platforms (Operating System, PC, Mobile Phone, ..) and it's easy to have access and to participate. There is a danger that e-mailing is misused as a tool for synchronous communication and becomes overwhelming.

- Wikis
  Are used for teaching and training-tasks. Works fine if usage rules are defined within the team. With some Wikis it's quite difficult and time-consuming to add some new content. It's not dynamic and the team-members may lose interest in using it.

- Document Libraries
  Are useful for management and communication. It's an essential tool in international projects. The tool should come with version control features with check-in/check-out rules. Security of data might be an issue if this tool is hosted in the "cloud".

- Discussion Boards
  Are useful for dialogues that take place over a period of time. Quality of communication improves with this tool, particularly in the collaboration of international teams. On the other hand it may take longer to get results and the discussion may get out of control.

- Web-Based Platforms
  These Platforms integrate some or all of the above listed synchronous and asynchronous tools (e.g. Video- and Audio-Conferencing, White Boarding, Chats, Application Sharing and Instant Messaging) are very useful because of

the possibility to combine the different tools in one user front-end and generate added value due to the combination of the different kinds of communication in real time. This type of communication can generate costs, depending on the kind of combined tools, the size of the group and when international participation is involved. Security of data might be an issue if this tool is hosted in the "cloud". Access to the platform might be difficult for some team-members.

There are also mixtures of synchronous and asynchronous communications. Convergence of synchronous and asynchronous capabilities is still ongoing, driven from a range of factors. These factors include the convergence of fixed-mobile technologies, an increasing use and acceptance of mobile devices and the introduction of wireless broadband as a consumer product. Examples are Google within the cloud environment and Microsoft mostly used as installed base at owned premises. Tools like skype are used in this kind of communications.

Other classifications points of view of communications are:

Verbal communication.
Divided into written and oral communication as well as images

Nonverbal communication.
Facial expressions, gestures, paralinguistic (tone of voice, loudness), body language and posture, proxemics (personal space), eye gaze, haptics (touching), appearance.

Now that the technical point of view of a communication and some tools have been explained, other important factors have also to be exposed.

Communication is crucial for the development of the project. If the ideas are not clear in between the team members of the project or between the project manager, the stakeholders or the clients certainly there is going to be soon a big problem. Communication is not only emailing, or talking. Three aspects determine the quality of a communication: Form, Method and Content [16].

Form
There are several forms of communication depending on how many ways of communication are involved [16]:

- One to one communication also called interpersonal communication.

- One to many communication also called presentational communication.

- Many to many communication as the ones which happen on brainstorms or debates between many attendants.

One way communications are usually used to impart information and no interaction is expected or desired, like in conferences or briefings. If there should happen any kind of interaction, the two ways communication should be used. The quality of the communication doesn´t depend solely from the form of communication, other aspects like the hierarchy between communicators play also an important role. If the boss of a big company holds a meeting, it is unlike that his employees will interact in the communication as they would do if it would be just another worker like themselves who leads the meeting [16].
Choosing the ideal form of communication for each situation depends on the ability and experience of the project manager. Sometimes it may be helpful to think about the best-case scenario and the worst –case scenario to figure out which form is the appropriate one in that moment [16].

Some guidelines for choosing the form of presentation are [16]:

- If it´s a personal talk with sensitive information (e.g. the worker is going to be fired or promoted) is better to use a one to one communication.

- Do not mix different topics in the same meeting unless it is necessary.

- Consider the appropriate form to communicate depending on what is going to be communicated:

  Presentations are good to inform people about the development of the project or changes in the project. Presentations are not good for discussions.

  For discussions with interaction between the workers a meeting suits best.

  For one-to-one discussions micro meetings or informal chats are the best.

- Method
  To choose which communication method to use can be sometimes overwhelming due to huge variety of communication tools available. Some basic considerations

have to be reviewed, like if you need a push approach (this means that information is send to the team member or stakeholder) or a pull approach (the interested part has to get the information by collecting or asking for it). Typical push tools are e-mails or presentations. Typical pull tools are blogs and noticeboards [16].
There are methods which support better than others some communication approaches. At the same time, another problem is how the workers conceive the importance or priority of the method. Some people do not take the e-mail too seriously meanwhile for others an e-mail has the highest priority. That´s always an issue which not seldom originates conflicts and the project manager has to be aware of this problem. The personal preferences of each person or stakeholder have to be respected and taken in consideration in the sum of the communication topic. The project manager should set the priorities for the key updates and decisions for everybody [16].

- Content
  The content is the information that is being communicated to the interested part. Three issues have to be clear when trying to communicate content [16]:

    The purpose of the content or what is supposed to be communicated?

    The structure of the content or how the information is going to be presented?

    The outcomes or what is the receiver supposed to do once the information has arrived?

  It is important that the project manager thinks not only about what he wants to get from that information, but also how are the receivers going to understand the message. E.g.: do all the used terms of the content mean the same thing to both parts (sender and receiver)? [16]
  The purpose of the communication has to be clearly set. Then the structure has to be analyzed. The structure has to help to communicate the content as effectively as possible. An example of how the structure works out the content of the communication could be highlighting the main topics of the content so that the receiver gets immediately the important part of the content. The outcomes: at the end of the communication often people doesn´t know what they are supposed to do from that moment on. A list of “things to do” or “next steps” would be really helpful. Outcomes

have to be very obvious to get a fast and accurate answer to the issue [16].

- Feedback loop
  Usually project managers care about how to keep the team members as well as the stakeholders informed. But often the problem is that the project managers forget that the team members as well as the stakeholders have to get in touch with the project manager also and so the feedback channel is poor or underdeveloped and inefficient. One possibility would be to dedicate the last 10 minutes of a meeting to the workers and stakeholders to interchange ideas or talking about unexpected problems. Also short informal meetings would be a good way that everybody can explain their ideas, clarify doubts or show their concerns. It is important that the project manager shows himself open to the team members and their situation [16].

3.6.1. Collaboration

Collaboration is the art of working effectively together. When a project starts, individuals with certain skills get together to work forming a group. The task of the project manager is to create an environment which helps to work effectively thus transforming the group into a team. The introduction of several measures like regular team meetings, specification on a poster or sheet of which communication tool is preferred by the different team members and public recognition of help offered between team members will set the pace of a proper environment for good collaboration. The transformation from a group into a team is clearly divided into 5 stages [16]:

- Forming stage.
  In this stage the workers meet for the first time and learn to know each other. This stage is dedicated to build up trust between the team members in order to promote a better collaboration. The project manager shouldn´t focus on the task each member is going to have along the project. Information about the background of the team members as well as their expertise should be interchanged. This helps to build up trust between the team members and their skills. Some information about the project can be shown but going into details should be avoided in this stage. In the first meeting every member of the team should be there. If this wouldn´t be possible due to remote working like in a virtual project or other reasons, at least a communication tool should be used to enable the chance to get in touch with the other team members (telephone, videoconference, chat and skype).

- Storming stage.
  In this stage everybody already knows each other. The differences of opinion show up and confrontations take place. Who plays which role inside the team, who is the owner of which deliverable and so on. There is a real danger that this stage never finishes. The project manager has to be aware of these confrontations, which at some level are normal but if they last for longer a solution must be found. If any solution is found to stop these confrontations, the success of the project will be endangered. The team workers have to learn to respect each other opinion and experiences.

- Norming stage.
  The team members discuss in this stage how the processes have to be done, trying to reach a commitment in the ways of working together. Williams warns of a phenomenon called groupthink "... where the group automatically assumes that the idea the group agrees on must be the best, and ignores outside inputs or different ideas...". The project manager has to be aware and if necessary promote the acceptance of different ideas.

- Performing stage.
  This is the most productive stage. The group has become a real team and now they can achieve much more than they could as individuals in a group. The roles are well distributed and the team members trust in each other skills to perform a good job. Conflicts are easily solved on this stage. The project manager doesn´t have barely to interact in this stage, especially compared to the previous stages in which he probably sometimes must have redirected the efforts of the team to ensure the proper development of the project. One of the main tasks for the project manager in this stage is to shield and protect the team from external influences which could interfere in their work, including the project board and management.

- Adjourning stage.
  This is the final stage in which after finishing the project, the team gets disbanded which may lead to some of the team members to a feeling of loss on separation. The sometimes long lasting projects and close working between some team members may lead to good relationships which get dissolved once the project finishes. Some of the team members will stay even so in touch together. A clear ending of the project has to be shown,

maybe with a kind of goodbye party celebrating finishing successfully the project.

3.7. Ending a project

At first sight it looks like that ending a project is pretty obvious and simple. But where must the finish line be drawn? When most of the deliverables have been finished? When some of the team members run out of work? It is pretty difficult to hold the team together when there isn´t enough work to do, especially because the team members are skilled people and pretty sure demanded somewhere else to keep on working. In the beginning of the project a plan was made in which the ending of the project had to be carefully planned. Now that the ending point has arrived, this planning will pay out [16].

Closing a project properly is an important task. As previously explained, it is important to know who is going to own and operate the deliverables, how is the project going to look like when it is finished, how have the deliverables to be delivered to the customers among others. Often, not caring about these issues makes it difficult to finish properly the project. This may produce frustration and an emptiness feeling to the members of the team. Make sure that all the project members and stakeholders are aware that the project has been finished. In the worst case, stakeholders believing that the project hasn´t been finished yet may come back one time and another time asking for small changes to be done or fixed in the project, which isn´t anymore part of the project. The moment to start to think to close the project is when the currently agreed set of success criteria from the original planning will soon be met [16] [1].

Special attention is going to be paid to the steps needed to finish a project and not the reasons a project should be finished. The reasons to finish a project are mainly two: success or failure. It is going to be supposed that the project was a success by meeting the stakeholder expectations throughout the project, respecting the deadline and all the terms of the contract. In the failure category there are two ways to finish the project [1]:

- Mutual agreement
  Both parts (the Project manager and the customer) agree to finish the project because the work should not continue.

- Breach
  One of the two parts didn´t respect the terms of the contract and thus the project is finished.

A project should be completely closed before starting a new one. This is something that due to the pace of business in today’s time is often

neglected because probably another project is already waiting to be started [16] [1].

These are the main steps to follow for closing a project [1]:

- Satisfy the client.
  This is the main step and should be done before closing the project. Make sure and document that the client has formally verified and accepted the deliverables. Deliver the project deliverables properly to the client.

- Make sure that all the financial issues are closed.
  All transactions should have taken place before closing. A financial final report should be developed.

- Be aware that all the contract obligations have been accomplished. The procurement advisors should take care about this issue.

- Archive all the reports and lessons (positive and negatives) learned through the development of the project. This will help to see how a problem was solved, how to avoid to make again some mistakes and problems, reduce learning curves and gain efficiency. Make sure that the data are easily accessible.

- Conduct performance evaluations.
  Already along the development of the project, feedback should be given to the team members. When their assignment is completed, make a formal evaluation of their performance, a workers curriculum. This documentation is often key to individual's career and an easy way to find members for a new project which have the needed experience and skills.

- Update your project experience with your roles, accomplishment and responsibilities. All the team members should do the same.

- Ask for references to the client.
  If the client is satisfied, he will give you the references which may improve the project manager career.

- Close accounts and charge codes.
  All associated accounts and charge codes should be closed by the account department.

- Make clear to all the team members that the project is closed. Celebrate it. This brings recognition to the team members for their endeavor and the accomplishment of the goals.

This is a list of the most usual methods of finishing a project [1]:

- Completion.
  The project has been finished successfully accomplishing all the conditions of the contract.

- Cancelled.
  The project has been cancelled due to poor performance, redistribution of the resources or change of the organization goals.

- Displaced.
  The project becomes obsolete because it lasts too long.

- Collapse.
  External factors like natural disasters, corporate failure or merge force the ending of the project.

- Absorption.
  The sponsoring organization needs the project as a permanent part of its corporation and therefore it loses its condition of project.

- Deterioration.
  The project gets its support and/or budget reduced and it becomes impossible to keep on working under these circumstances.

3.7.1. Tools and best practices

Some of the tools and best practices which could help to close the project are [16]:

The project review meeting
This meeting should be a short presentation for the project board, the stakeholders and the team members about the products or processes which have been delivered, not about all the steps taken or left or the issues which happened along the development of the project. At the end of the presentation there must be an agreement that the project can be finished and a short list of the tasks to do until it finally gets closed.
This is probably the most important meeting of the project, therefore an agenda should have been send in advance and the project manager must be sure that all the key participants of the project will be there. The project manager has to be well prepared for this meeting knowing most of the details of the deliverables [16].

Project sign-off
This must be a document in which it is detailed what was delivered, a change log of decisions made through the project as well as the original planning. This document becomes essential when a contract was signed before starting the project. The customer should show his agreement for the received deliverables by signing this document and so closing finally the project and accomplishing the contract avoiding future problems.

Customer feedback
This is a practice by which the project management and not what was delivered will be evaluated. The customer has to evaluate if he felt well informed along the development of the project, if his concerns were considered or not, what was well done and what should have been done better. If there are several customers it will be better to hold an informal face-to face meeting with all of them at the same time to get their feedback. Asking for a feedback can leave a good impression for further projects, because the customers get the feeling that you really care about your management skills and if necessary you are willing to improve yourself.
Organizations which use to have many project may have an internal evaluation of the job done by the project manager. This is known as *key measures score* and it evaluates how well was the planning and development of the project according to internal criteria done.

Lessons learned session
This session should focus and all the things which went well, the ones which didn´t go well and how these were fixed or maybe couldn´t be fixed why and how they affected the development of the project. This experience will help to prevent future issues from happening or if they happen how to fix them as fast as possible. The best way to hold a session like this is holding a brainstorm session and following the stages of the project through the original planning to refresh the people memories.

4th Chapter
Main issues in dealing with a virtual project management

The most important aspects of a virtual project management is that all the team members trust each other. This trust has to be build in the kick-off meeting. It facilitates the sharing of important information between teams of a virtual project. This information sharing may be one of the main issues in a vPM as in [22] and [18].

To enable good collaboration between the teams of a virtual project it is first necessary to create an appropriate environment. There are five main factors divided into three categories that affect the proper collaboration between teams of a virtual project. These factors and their categories are [22]:

- Virtual barrier
  - Overcoming distances by using *Virtual Communication Channels* (VCCs)
  - Different time zones
    - Ineffective use of the right VCCs
    - Global time differences (the bigger the time difference, the worse)
- Cross Cultural barrier
  - Lack of foreign languages skills among the members of the *Cross Cultural Virtual Teams* (CCVT)
  - People from different origins and backgrounds show different perceptions of reality
  - The virtual barrier increases these difficulties
- Lack of support of the Companies
  - Some companies are new to the virtual characteristics of a project and still don´t know how to manage it or have a lack of trust into virtual teams and therefore they don't support them as much as they should

The combination of all these Factors worseness the collaboration between the teams of the virtual project and therefore endangers proper knowledge share and the successful development of the project.

4.1. Virtual Barrier

Overcoming distances is the main issue of virtual barriers. Here are some of the mistakes which happen because the VCCs aren´t used properly.

It is important to use effectively the VCCs as well as the right mix of VCCs to ensure a proper communication or knowledge share. It happens often that the team members doesn't know which VCCs

should be used, how to use them or didn´t use them because they didn´t like the VCCs despite the fact that it was necessary to use them. At the same time the VCCs have to be able to adapt to the characteristics of the communication. For instance, human conversations are not only about the content of the spoken message, the intonation, the pauses and the body language are added to the content of the message making it a complex communication. This is called a high context communication and is often a missed point in virtual communication channels [22].

4.1.1. Inappropriate use of VCCs

The kind of information to share determines which kind of VCC should be used. Often, the team members use not appropriate VCCs for the information to share [22].

In some cases tools like e-mail, which is a low context VCC, were used almost all the time. Complex messages are usually not well understood if they are communicated through this tool and there is no chance to check them back immediately. To the complexity of the information it is added the fact that the language used in the e-mail probably is foreign to the receiver, which increases the chance to misunderstand the information. At the same time there was no evidence that the e-mail was received properly, too late or if it was received at all [22].

On the other hand, people use to add too often a CC or a BCC to the e-mail which result into spam-like massive mails which had mainly two effects [22]:

- People wouldn´t care about e-mails.
- If the e-mail was addressed to one specific person with private or confidential information, the CC and/or BCC would interfere into his/her private sphere and lead to conflicts or undermine the trust into the sender.

A phone call is more spontaneous and enables a dialog in between the parts. An immediately check of the message is possible in case something hasn´t been properly understood. But again the intercultural barrier plays an important role in a telephone call. If the people doesn´t have much background about the project, everything has to be explained only through words, and that is not always that easy. The skills of the explainer into choosing the right words have to be really good to synthesize a message with strictly the needed information in a comprehensive form. If at the same time the counterpart of the conversation is foreign to the language used in the phone call, the chances of misunderstanding or not understanding at all the conversation increases [22].

The body language plays no role in a phone call because it can´t be seen, and thus it´s not easy to see if the counterpart has understood the message. On the other hand, in some cultures it is extremely difficult to say "NO" to somebody even if they want, so, the virtual project manager has to be aware of these issues and instead of asking something like: "Did you understand everything?" or "is everything ok?" which could be a problem for some people to answer with a "NO", it would be better to ask something like "Do you have any question?" or "Is there any problem?" which allows to the other person to show that there is a problem by saying "YES" which is easier for them[22].

A teleconference is a phone call for many people at the same time, without video. Therefore Teleconferences have the same problems as phone calls. There is no body language involved at all. At the same time, there are many voices talking, maybe sometimes at the same time. Recognizing the voices, trying to understand people with strong accents, people whose language skills are not good enough or distinguishing the voices when some of them talk at the same time is really demanding and exhausting and makes it really difficult to understand the information. Not understanding the message or having the feeling of not being understood leads to frustration and to the feeling of not belonging to the team [22].
The higher the number of partners of the teleconference the longer will be the phases were people doesn´t have to talk and only have to pay attention, which leads to boringness and lack of attention, thus misunderstanding of the message [22].

4.1.2. Ineffectiveness of VCCs according to people´s expectations

The effectiveness of tools decreases when these don't accomplish the expectations of quality or doesn't have some properties team members expect them to have [22].

Team members said that telephone calls cut some frequencies of the transmission which made difficult to understand the communication partner, especially if that person had a strong accent. In teleconferences the acoustic feedback would worsen this effect decreasing the quality of the communication [22].

One of the main problems of videoconferences was that voice and image were not synchronized or the image refreshing rate was too slow which effect was that people had robot like movements. The consequences were that the body language was not interpreted properly or delayed answers or reactions to questions were considered out of context [22].
Extremely dispersed teams had the problem that videoconferences could never be held because these would take place extremely early for some team members and extremely late for other team

members, thus it had to be held by phone from the home of the team member [22].
In some lower-developed countries the communications used to break down often because the telecommunications infrastructures were not properly developed, making an adequate communication almost impossible [22].

Sometimes it happens that despite of the fact that the new tools accomplish better their purpose, the team members used only the basic functions of the new tools or tried to stick to the old tools they already knew because they were afraid of having to learn to use new features or this learning would be too time consuming. For instance, whiteboards were barely used despite the fact they were designed to improve the interaction between team members [22].

One of the main problems are the big time differences between teams into a widely spread out virtual project. Big time differences make it impossible to have a quick talk about urgent matters, e-mails are read hours after these have been written, team meetings become almost impossible and even if an arrangement has been met, it often happens that some members doesn't show up in the meeting and are not available on a phone call at this moment [22].
Big time differences doesn´t also allow the use of high context VCC (because it is impossible to get all the needed team members at the same time together) which has as a consequence a reduced transmission of context and therefore a loss of information, like in [22].

4.2. Cross Cultural Barriers

The Cross Cultural barriers are not only about different languages if the teams are highly dispersed, they are also about different perceptions of the reality depending on the geographical situation of the teams and their background. For some teams it would be extremely important to be on time every time and try to follow strictly the plans and deadlines. Other teams wouldn't care that much about being on time or the deadlines for the projects wouldn't be that rigid. If these two teams had to work together and the virtual project manager wouldn´t care about these differences, the virtual project would have very few chances to be finished successfully [22].

4.2.1. Language skills

A common language has to be set for the project. All the team members have to have good skills in this language; otherwise the communication will become very difficult. But often, the language level is medium or even low but the skills of the experts are needed so they are asked to join the team. If somebody is not able to express himself properly in the common language, this is taken as a

sign that the skills of the team member are not good enough and as a consequence there is less trust into the job done by this team member. The opposite could also happen. If a team member is extremely fluent in the common language and entertaining, his skills could be overrated [22].

Mastering the common language may not be good enough. There must be also some country-specific language skills [22]:

- Sometimes same words as well as the ironic use of the language may have completely different meaning to different team members and lead to misunderstandings.

- The use of the language may also be a problem. For instance, Germans like to be direct, kind of military order when they want that something has to be done the way they want it. British people would say "maybe it would be better to do it this way" which would be understood by German people just as a suggestion and not that this is the way that the British people want it to be done. On the other hand, the German approach would be extremely rude for British people.

Often, a solution to this issue could be the introduction of a specific project dictionary to avoid comprehension problems.

4.2.2. Different perceptions of the reality

There are different factors which may influence in the reality perception of a company [22]:

- External factors like political systems, traditional values, infrastructure and competitive environments.

- Internal factors like the founders, the surrounding environment, the directive staff, the hierarchy, the workers and their background.

Organizations have to adapt all the time to external trends to remain competitive. This adaption capability varies depending on the size and structure of the company [22]:

- Size
  Smaller companies might be more flexible than larger ones to adapt to new trends.

- Structure
  A strong vertical hierarchy structure would have a different influence in their employees than horizontal hierarchies. In the latter one an open door structure would be possible but not in the first ones.

If the teams are really widespread it is pretty possible that the perception and habits vary strongly. For instance, a virtual project with a team member from an Asian team. Asian teams use to have a very strong vertical hierarchy, which leads to the fact that any decision which has to be taken by the Asian team member depends from his superior and not from himself. If these decisions are not taken fast, whatever the reason may be, it may happen that the job gets delayed until the decision makers are ready to decide. This means that the project manager has not only to include the Asian team member in his team but also his superior [22].
In teams with horizontal hierarchy or a low hierarchy it may easy to get to the needed information and to react fast. Team members of teams with strong vertical hierarchy won´t have easily access to all the information and therefore the reaction time has to be slower. This can be interpreted by the low hierarchy team as laziness or incompetence from the team members [22].

If the project manager doesn´t care about the different reality perceptions between the team members, conflicts, delays and lack of trust among team members may be the consequence. This leads to frustration, lack of motivation and efficiency in their job, delay in the jobs for the project which could finally end in the project failure due to a wrong virtual project management [22].

4.3. Lack of support of the Companies

Many reasons may have as a consequence a lack of support of the companies to the members of the virtual teams, which affects the proper development of the virtual project. Here are some of the reasons [22]:

- The top level managements of the company were not aware of the increased complexity of a virtual project.

- Some team members believe that the expectations of the local manager are prior to the ones from the virtual project manager. This may happen because the top level management didn´t offer enough support to the virtual project manager by specifying the hierarchy to follow in the human resources statutes. The remote assessment wasn´t perceived by the

virtual team members as more important than the local assessment.

- Employees hired to work from outside of the company may have problems to join the company's intranet and/or doesn´t barely get any support from the technological department.

- Sometimes the main reason for a company to start a virtual project was to reduce travel costs and thus reducing the budget. This could lead to problems specially if some team members were completely new and didn´t have any previous support. Even with distance training, some team members claimed that they felt frustrated because they felt that some complex tasks could only be solved face-to-face.

4.4. Successful management of virtual project

There are many reasons that make it worth to take the effort and face a project as a virtual project. If the following strategies are applied, the chances to finish successfully a virtual project increase dramatically. Along the strategies there will also be explained the advantages of a virtual project compared to a classical one [22].
Compared to a classical project, the team members recruited for a virtual project are people suiting the required criteria in the best possible way because they can be chosen from all over the world. This also supposes that these experts will show different views and strengths because they live and work in different environments, which may provide the team with an enhanced pool of different problem solving strategies. If the virtual project manager does its job properly, the team members could then collaborate together without any problems allowing them to solve problems in a creative and innovative way. This shows that teams from a virtual project have the potential to be exceptional good performers which may be a significant advantage for the company´s competence [22].

4.4.1. Company support for virtual teams

The team members of virtual teams should be integrated into the company values and statutes in order to make more effective the communication among them. This means that the company has to have already a virtual organizational culture: virtual working methods should be standard in the company´s working culture. If the virtual teams are included in the company´s statutes the virtual team worker will have a belonging feeling to the company because it feels that the company supports his job and thus improve its

efficiency. This also includes the same rewards and promotion as the collocated workers of the company [22].

The company should have or create intercultural departments as well as training support centers. These departments should be in charge of the training of the virtual team members in effective communication, virtual working, intercultural communication and if needed language skills improvement. A kick-off meeting with training is very important because after just four and half months the virtual team is already efficient. Without the kick-off meeting and the training, this efficiency would be reached after nine months. The cost of this extra time as well as the cost of a possible weaker outcome of the virtual project should be included in the budgeting [22].

It is crucial that the top management and the financial departments shouldn´t perceive the virtual teams as just being a little bit different than normal teams. This point of view usually leads in crisis times like nowadays happens, to shorten the budget of virtual teams. These departments have to realize that in order to perform well, it is necessary to have a specific virtual team management, selection, training and leadership and therefore an appropriate budget [22].

Despite of the fact that face to face meeting are seldom in virtual projects, these are few times are extremely important. At the beginning the kick-off meeting should take place as far as possible. This meeting helps that the different virtual team members learn to know each other and thus to trust into each other. Only in case that this meeting is completely impossible to take place and as a last alternative, training could be provided virtually in moderated meetings with the help of several tools which could share documents, video sequences, etc.. [22]
In no such extreme cases, face to face (F2F) meetings should be held from time to time. These help to clarify complex situations and to maintain the team feeling as well as the trust into the other team members [22].

At the beginning there have to be set some rules to follow by all the team members. At the same time it has to be clarified which role plays each of the team members in the project. This provides a clear team structure and helps to create a stable basis in which all the team members can relay. Meetings, schedules, reports, defined objectives, clear tasks among others are part of the rules [22].
Part of the rules would also be a higher tolerance to mistakes due to the extra complication involved in a virtual project. In normal projects a mistake would mean usually that the project manager would get laid off easily. This means that the new project manager would have to get also through the same situation, do the same

mistake and have no chance to learn from the mistake. The consequence of such a way to handle was that most of the people didn´t say anything just to not get fired in case of a mistake. This should change for virtual projects, allowing the vPM to learn, improve and get a better sharing of their knowledge [22].

It is important that the team members were committed to the project, even if this means to held from time to time a late in the night or early in the morning videoconference to discuss important issues. To be a member of a virtual team requires flexibility and being ready to work like this [22].
If even so it is not possible for all the team members to attend the meetings, these can be recorded with documentation tools, allowing a later access for those who couldn´t join the meeting. These documents should be updatable and accessible for all the members [22].

Virtual team meetings are more difficult than standard meetings. Therefore an efficient meeting should be a priority. The more heterogeneous the people, the bigger will be the effort to arrange an efficient meeting. Sending prior to the meeting an agenda, writing down a report to everybody short after the meeting and to appoint a moderator are good ways to have efficient meetings. The moderator has to help the team to seek a consensus, to stay in the time frame, to give a final overview of the discussed points, clear uncertainties and unanswered questions, translate cultural differences, giving introvert people the chance to participate in the meeting and making it clear that talking a foreign language is not easy and even so everybody should express their opinion and concerns [22].
Virtual team meetings use to take longer than normal meetings due to the added difficulty in the communications, and every team member should know that. Another task of the moderator is to shorten this time difference as much as possible [22].

The working environment and reality of virtual teams are way more complex than the one from a collocated team. The already explained possible problems added to the intransparent virtual environment, the language skills, the time differences, dealing with people with different habits and backgrounds can only be managed by people with special high skills. There are several factors which have to converge into the personality of the ideal virtual team member [22]:

- Communication skills.
  The team members have to be able to express themselves in a persuading way being at the same time diplomatic.

Ideas have to be communicated to all kind of people with different backgrounds and perceptions of the reality.

- Intercultural skills.
  Having an intercultural background would be helpful to know how to behave with team members from other countries.

- Interpersonal skills.
  These are essential skills because they are inherent to the personality of the expert and cannot be trained. These skills help to be tolerant, be interested in the colleagues situation, respecting people from any background and origin, having the ability to establish relationship with different people, contributing to a enjoyable working atmosphere.

- Leadership skills.
  Some leadership skills would be desirable because sometimes they may need to lead certain areas of the project, of course within their professional field.

- Methodological skills.
  They have to be able to manage themselves, which means to be organized, deal with insecurity and emotional challenging situations, problem-solving skills as well as time-management skills, etc..

- Team working skills.
  Being focused on the goal of the project rather than on the own goals, wish also the success of the other team members are some of the skills included here.

- Technical skills.
  Using media tools, being proficiency in foreign languages and having high skills in the on professional field are the demanded skills here.

In summary, a virtual team member is somebody who should have a strong personality, being open minded, taking the things easy, willingness to face new situations, searching for new approaches as well being prepared for innovative solutions. Good listening skills, having some empathy and very important, being able to adapt

rapidly to changing situations, e.g.: changing from a conversation with a German team member to immediately talk to an Indian team worker or a Japanese one, adapting to the characteristics of each of the partners.

4.4.2. Effective use of VCCs

The virtual team members have to have or acquire the knowledge to choose the appropriate VCC for each kind of information to transmit. Low context messages could be transmitted with an e-mail or a phone call, higher context messages should be transmitted with VCCs like videoconference or if necessary, face-to-face meetings [22].

It is important that the sender of the message faces himself into the situation of the receiver to figure out if the message may be understood the way the sender expects and only this way. If ambiguities are possible, the message needs to be complemented in order to avoid misunderstandings [22].

Sometimes some team members just do not answer a message. Maybe because he didn´t notice that he got a message, or just thought that no answer was necessary or couldn´t get the demanded information and was waiting to get it to answer the message or any other reasons. This attitude could create uncertainty, or bad temper from the sender against the receiver and in any case delay the development of the work. Therefore it would be appropriate to give a short answer just to let know that the message was received and that the receiver was working on it. A short e-mail or a short phone call would be enough [22].

4.4.3. Some recommendations and advantages of using VCCs are

This is a list of suggestions of how to take profit of the VCC´s [22]:

E-mail:

- Being in a quiet environment when writing an e-mail helps to choose the appropriate words and expressions, especially if it is not the mother tongue of the writer.

- The possibility of sending it at any time including different kinds of attachments.

- Asking for an arrival confirmation of the mail.

- If the content of the e-mail is not only low context, it would be helpful to discuss the content of the e-mail through the phone with the receiver once he has got it.

- To avoid an overflow of e-mails it is important to decide who has to read the e-mail, avoiding the overuse of the cc characteristics.

Telephone:

- Useful for task-related issues, quick agreements and arrangements.

- Recording important calls would avoid misunderstandings.

- Should be complemented with informative e-mails.

Teleconference:

- A moderator should be giving turns to speak by addressing to the team members by their name. He should also urge them to speak slowly. At the end of the meeting the main points of the teleconference should be summarised by the moderator. He should also encourage the team members to repeat the topics which haven´t been understood before properly.

- An agenda and time management of the teleconference would avoid tiring and boring phases along the communication.

Videoconference:

- A videoconference is a high context VCC because it allows the transmission of sounds, images and body language.

- Good infrastructures are necessary to ensure a proper quality of the transmission.

- A minor solution, in case of bad communication quality, was the use of online meeting tools and a static image of the partner on the screen.

4.5. Virtual Project culture

It is necessary that the virtual project manager sets some rules which have to be followed by all the teams and team members. Some of these rules are:

- A common language.
- Common ways of reporting deliverance.
- Common ways of documentation storage.
- A common dictionary and thesaurus, including all the abbreviations and shortcuts necessary to the project .
- Behavior and communication rules, to avoid and mitigate conflicts.

These rules and the relationship between the team members are the base to promote a common culture inside the virtual project, which would give a project belonging feeling to all the team members and improve the working ambience, the collaboration and therefore the efficiency of the virtual project.
The development of a virtual project culture would facilitate the adaption of the team members to new processes due to the already familiar structure provided by the project culture. The team members would know how to deal with the new tasks instinctively, just following the rules and procedures of the virtual project culture. No new rules had to be established by the virtual project manager.

Part III
Practical point of view of a virtual project management

5th Chapter
How to make a virtual project

Within this chapter there will be briefly showed which steps should be taken to decide if a project has to be virtual or not and how to start, develop and finish a vPM. There will be also analyzed virtual projects and answered questions about which conditions would make a virtual project management to be suitable. Some advices will be given about why and when a project should be virtual, how should a vPM be organized, who should work in a vPM among others.

5.1. Why should a Project be virtual?

A customer asks an enterprise to create a new product, service or need. The enterprise asks for a feasibility study to see if the assignment is possible to be done or not. If the study is positive, the next step is to establish the terms of the assignment. These terms are: The amount of time available, the budget and the characteristics of the assignment. The sum of these terms is called project charter.

The project manager gets the project by getting the project charter. This project charter determines how to carry on the project: traditional (PM) or virtual (vPM). The task of the project manager is to recognize how the project has to be done by the characteristics of the project charter. He cannot decide how to do a project by his own.

Some of the characteristics of the project charter which lead to the fact that the project should be a virtual project are:

- Deadline is too short for a typical working hour rate (usually 8 hours/day). A 24 hours/day work has to be implemented, by working with teams on different time zones.
- High skilled workers are needed for a short time.
- Multicultural teams are not a problem. The PM has to care that the multiculturalism doesn't become a problem.
- Having less control over the teams is not a crucial factor.

A virtual project has also other advantages:

- No need to relocate existing workers.
- Attracting the best workers independent of location.
- Flexibility.
- Reduction in travel time and expense environments requiring inter-organizational cooperation.
- Shifting towards service work.
- Global workdays (24 hours vs. 8).
- Changes in workers expectations.

The chance to have a 24-hours workday shortens significantly the time it takes the final product to be finished, and time means money. Despite the fact that investments in communications technologies have to be done (including training if necessary), these expenses are lower than sending some workers around the globe, maybe several times along the project.

There are two kinds of vPM:

Distributed Project Management
In this model of vPM there is one company which gets in charge of the project by getting the budget and the project charter. The project manager has to organize everything to proceed with the project. The PM has mainly the control of the project.

Virtual Corporation Management (vCM)
In this model of vPM one company gets the project, but for some reason other companies also take part in the project. This leads to several problems. The other companies want also:

- To take part in the decisions of the project.
- Controlling the project.
- Sharing the benefits of the final product.

The Project manager has two options in the vCM case:

The project manager has to take the absolute control of the project by taking himself all the decisions or enrolling people who help him to take these decisions.

The other option is to get to a commitment with the other companies for a common governance model. One governance model could be the one from the company which got the project assigned or to get to an agreement between all the companies for a common governance model.

5.2. Steps to follow to start a vPM

After the evaluation of the project charter by the project manager and having recognized that it has to be a vPM, the project manager has to proceed with the following steps:

- Get in touch with the needed skilled people. These high skilled workers should get offers which make it interesting for them to join the project. Specialized websites like e.g. XING or Linked are good places to search for them.

- The framework or method (e.g. PRINCE2, HERMES) has to be set by the PM to carry on the project. All the needed steps accurately prepared, like programming the overhead or the servers for automatic reporting and valuating.

- A Kick-off meeting is necessary. In this meeting the project manager has to explain the goal of the project and the deadline. He also has to explain or get to a commitment with his workers about the tools, the rules, the procedures, the schedules and how, when and to whom make the reports.

In the Figure 17 it is depicted the process of starting a vPM:

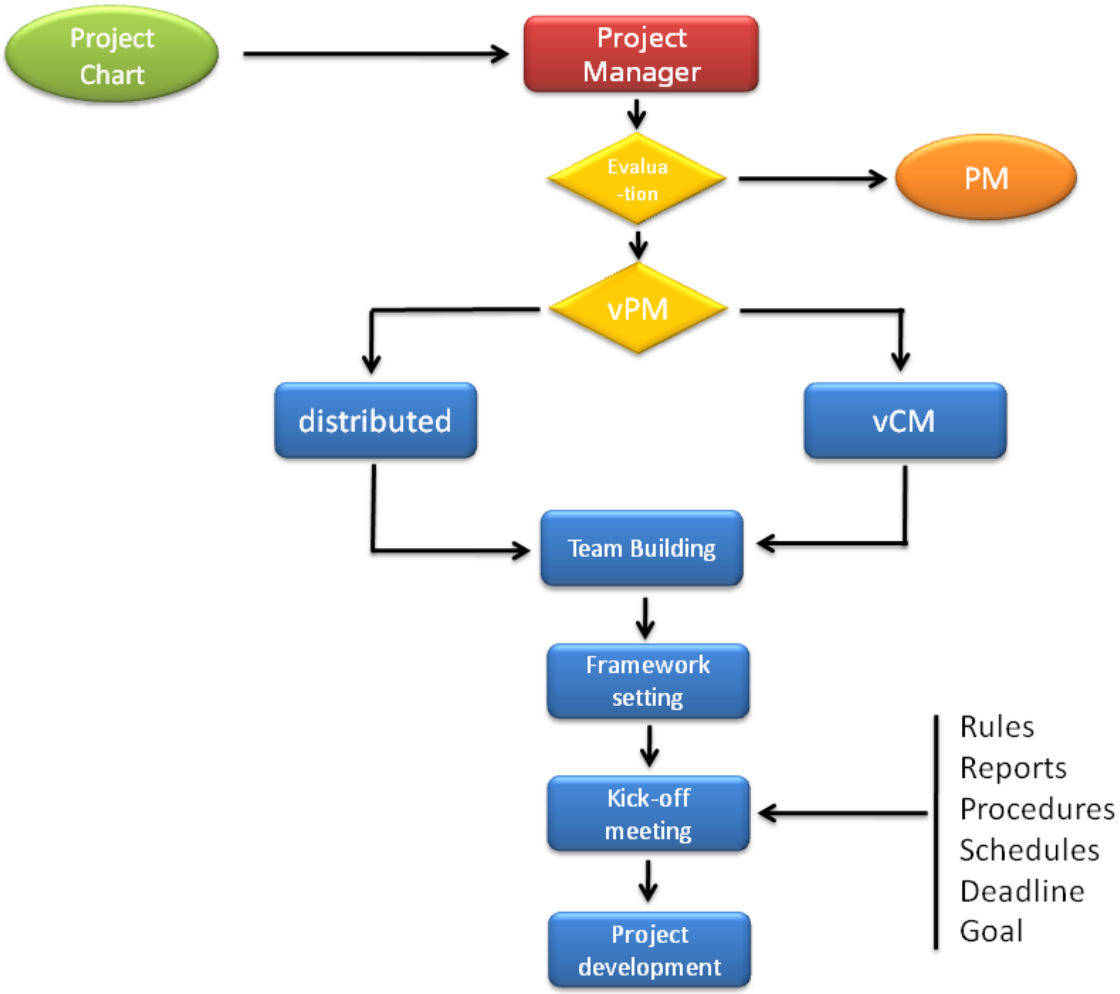


Figure 17 Starting process of a vPM

5.2.1. Use of tools and methods

Before the project can start its development, the virtual project manager has to think about how this development is going to take place. He has to decide how processes like reporting, communication, back-ups, controlling among others are going to happen. All these processes have to be accurately prepared to ensure a proper development of the virtual project. The virtual project manager has mainly three options for this preparation:

- The virtual project manager has to pick up a set of tools which will be used along the development of the virtual project. These tools cover several topics like communication and data storage among others. In the kick-off meeting, the virtual project manager has to get an

arrangement with the team members about which tools of the set should be used and how. This is the tools set.

- The vPM can add to the tools set an established method like PRINCE2 or HERMES. These methods have clear specifications how processes procedures, like for instance how the reports have to be done, when, where and how should these be stored; how controlling will be done and so on. This easies a lot the work of the virtual project manager along the development of the virtual project because there are clear procedures to follow for him and all the team members. This is the established method.

5.3. How a vPM should be developed

Once the kick-off meeting has taken place, in which the rules were introduced and the teams set, the main task of the project manager is to supervise the development of the project. He has to analyze and evaluate the reports and keep on organizing the teams, if necessary. The project manager has also to report to the stakeholders. In these reports the virtual project manager should provide the stakeholders with the necessary data to allow them understanding and control.

5.3.1. Project controlling

Project control (see point 3.5, Chapter 3) is one of the main issues of the development of a virtual project. It's all about prevention, detection and action [1]:

- Prevention
  The variances which may cause problems have to be minimized if elimination is not possible. To do this it is necessary to invest in planning, monitoring risk factors, communicating effectively and delegating work clearly, among others.

- Detection
  The earlier a problem is detected the sooner it is possible to solve it or even avoid it. Typical detection methods are performance reports and review meetings. To realize if an issue may be a problem it is necessary to see how this issue has developed along the time. This issue may be any of the success critical factors like stakeholder expectations and quality. It is important not to stay focused only on schedule cost and scope of the project.

- Action
  This principle is strongly related to early detection. Once a problem has been detected an appropriate and timely response has to be taken. Usually these actions are corrective actions, change control procedures and lessons learned.

5.3.2. Reporting

The framework, which is common to all the virtual teams (it was set at the kick-off meeting by the virtual project manager), includes an Overhead. This overhead can generate automatically scheduled reports (daily, weekly…) making the work of the virtual teams and of the virtual project manager easier. In fact, ideally most of the routine tasks needed in a virtual project should be automated by the overhead. The fact that the overhead generates automatic reports of the work of the virtual teams is also a safety issue. If the teams would generate the reports by themselves, it is possible that the reports could contain some errors or mistakes which could change the risk perspective of the virtual project after analyzing these erroneous reports. By setting an automatically generation of reports, the virtual teams cannot influence in the report and so this one is really showing the actual situation of the work of the virtual team.

The generation of reports from all the virtual teams should be done following an established scheduling. The reports should be stored in servers, which should care if a report has been received and stored or not. If a report, after a short period of time (5 days, for instance) hasn't been stored in the server, the virtual project manager or the virtual team member who has to analyze this report, should get a notification. A delay of this kind could mean that the virtual team is not doing their work properly, the communication is not working or the server has problems to receive and/or store the reports. Any of this issue could become a big problem for the development of the virtual project. All the reports and generated data of the teams should be stored and an automatic back-up should be done for safety reasons.

Risk Management

This is one of the main issues of any virtual project management. The procedures to mange risks are the same as the ones explained in 3.3.5 in Chapter 3.

The virtual project managemer has to add new risks to the ones that are common to the classic project management. These new risks are originated by the unique characteristics of vPm: the cultural barrier, the time differences, the language barrier and the technological barrier. The last barrier is mainly common to both kinds of project management, but a virtual project relies much more on the technology

than a classic project. The virtual project manager has to be aware of these extra risks and plan them carefully to avoid the failure of the project.

Data back-up
The back-up of the data and the reports should be at least one of the automated tasks. The back-up of the data should make it easier for other teams to get needed data to consult or to work with. In the rules, the PM has set which team has to get which data and given them the permits to access to this data.

Controlling
is not only about processes. The management skills of the PM play a very important role. Leadership, effective communication, analysis and team management skills are crucial.

The following processes are fundamental for project control:

- Performance reporting
  The stakeholders will be informed of the performance by measuring critical success factors, corrective actions, key factors among others.

- Configuration management
  It controls changes, versions and updates of project derivable, the approving, reviewing and coordinating any alteration of the scope of the project.

- Risk management
  Risks have to be monitored, identified and responded.

- Change control management
  Any request for the alteration of the scope of the project has to be reviewed, coordinated and approved with this process.

- Issue management
  Issues which may have an important impact in the success of the project are identified, tracked and resolved within this process.

- Requirement management
  That all requirements are met, documented and tracked is the task this process has to accomplish.

- Procurement management
  Controls the vendors and suppliers involved in the project.

6th Chapter
Conclusions and future tendencies

How to make it easier

The virtual project manager has a huge task to accomplish by managing a virtual project. He should try to get the maximum benefit of tools which should make many time-demanding processes become as automatically as possible. These tools should ease his job.

6.1. Framework setting - Overhead

For the virtual project, first were introduced a set of tools and afterwards the method (PRINCE2, HERMES..) was implemented. This way everybody had standardized ways to do all the tasks.
But there would be another option which could make the development of the virtual project much easier. If all the processes could be made automatically, all the team members would save lots of time and efforts. No routine task should be made by hand. This option would be the creation of an overhead. This overhead is composed by many programmed workflows. Most of the processes can be programmed as a workflow in the overhead (e.g. reporting, controlling, reviewing, risk management). The more workflows programmed, the easier will be the controlling of the virtual project by the manager. This takes time but it pays out in reliability and efficiency.

At the finishing of the virtual project, these workflows have to be stored, and indexed, as part of the knowledge management. This way, these workflows can be reused instead of being programmed each time again, making it easier the preparing of the overhead for the next project. The more processes the overhead is able to perform, the better but the more time takes the preparation (programming) and the time for the development of the virtual project diminishes. The virtual project manager has to evaluate how much time pays out to invest in preparing the overhead versus the time available for the development of the virtual project. Another problem is that most of the workflows designs are attached to the method picked up. If in another project the method has to be changed, the workflows have to be programmed again. Ideally these workflows should be programmed to be independent from the chosen method.

The figure 18 shows how the project overhead could finally look like:

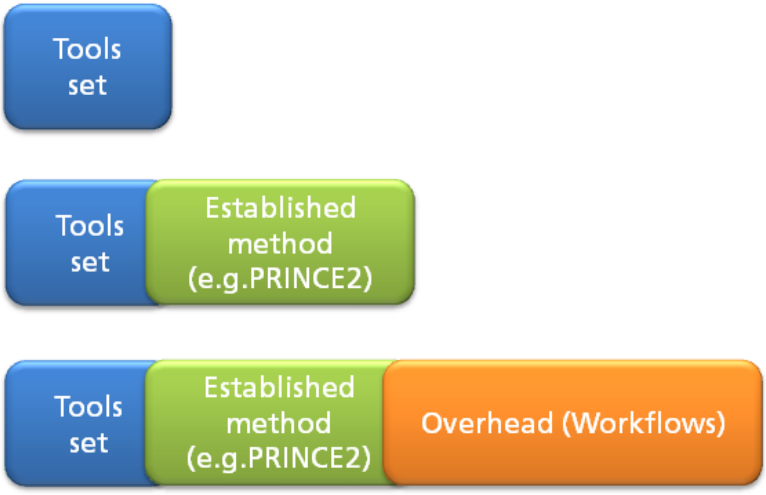


Figure 18 Overhead of a vPM

6.2. Reporting/Risk management

Reports are for a virtual project manager usually the only way to control if everything is working fine with the virtual teams. The analyzing of the reports helps to prevent possible delays or problems emerging in the teams, which could affect the development of the project.

The framework and the included Overhead should generate automatically scheduled reports making the work of the teams and of the project manager easier. In fact, ideally most of the routine tasks needed in a project should be automated by the overhead.

This would also be a safety issue. If the teams would generate the reports by themselves, it is possible that the reports could contain some errors or mistakes which could change the risk perspective of the project after analyzing these erroneous reports.

By setting an automatically generation of reports, the teams cannot influence in the report and so this one is really showing the actual situation of the work of the team. The overhead should compare the results and the date of sending of the reports with a previously established calendar and results expectations. The valuation of the difference between the obtained results and report sending date could be classified as:

- Positive.
- As expected.
- Negative.

A new report should be generated with these valuation and send to the project manager for further analysis of possible risks. This way the

virtual project manager doesn't have to wait until all the teams have send the scheduled reports, collect and evaluate them. He gets directly an evaluated report called Risk Report for further analysis. This process is shown in the next figure:

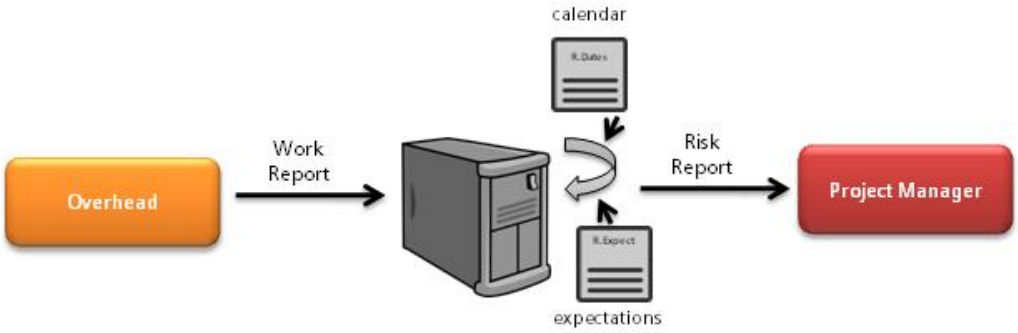


Figure 19 Overhead reports evaluation

6.3. Future tendencies

Nowadays, most of the software focuses only on planning, execution as well as controlling. In the future, new tools will also include the initiation and the closure of a project. In the initiation there are included following topics:

- Feasibility studies.
- Benefit-cost analysis.
- Risk management.

Some of the topics included in the closure of a project which future software will also consider, may be:

- Reporting of acquired experiences along the development of the project (positive and negative).
- A Library with the best practices.
- A failure analysis.

These topics will be available for other projects, preventing to repeat the same mistakes or inappropriate procedures

6.4. The Cloud

Another possibility to manage a virtual Project is using the cloud. In the past, to work on computing tasks it was necessary to buy a license for each application in order to install the software on the user´s computer. This could be expensive if there were many users working on the same project having to use many applications. It was also a problem to actualize the licenses of all these applications for all the workers [14].
With the development of local area networks (LAN) and the network capabilities, the client-server concept was born. The main application was hosted on server computers with enhanced computing capabilities. The user had to have only a network-friendly version of the application. The CPU and the memory of the user´s computer were used for the processing meanwhile the resultant application data files were stored in the servers. There were purchased multiple user licenses for all the workers [14].
Cloud computing differs from LAN computing. The whole application software as well as the memory and the processing capacity are provided by the server computer in the cloud. The user only needs to have a web browser which executes and manages the application stored in the server. The resulting application data files are also stored at the server computer and can be recalled whenever the user needs them. The software as well as the hardware are depending completely from the cloud service providers and the user doesn´t have to care at all about licenses or out of date hardware. The user pays only for the time of usage [14].
Nowadays users already use applications which could be considered to be in the cloud because these applications are working outside of the user´s computer and stored in the net, like Gmail[14], Hotmail[15], GoogleWave[16] or Office365[17] (still in beta version).

[14] https://www.google.com/accounts
[15] www.hotmail.com/
[16] http://wave.google.com/wave
[17] http://www.welt.de/wirtschaft/webwelt/article10418643/Microsoft-startet-Office-Programm-im-Internet.html

An example of cloud computing is depicted in Figure 20:

Figure 20 Cloud computing [F1]

The virtual project manager should set which applications of the cloud should be used for applications and which ones for storage of applications data.

6.4.1. Advantages of cloud computing

The main advantages of cloud computing is the whole hardware and software is completely transparent to the user. This transparency means that the user doesn´t have to care about which hardware has to be used, if it is up to date, as well as if the software is properly licensed or updated etc... [14].

Other important advantages are [14]:

- Scalability
  If the user needs more performance, it is disposable at any moment. The user doesn´t have to have any extra hardware "just in case" anymore.

- Instantaneous
  This increased scalability is provided immediately, the user is not aware at any moment of the change in the scalability of the application.

- Money saving
  The use of the hardware and of the application is paid only as long as it is being used. Once it isn´t used anymore, the user doesn´t pay anything else.

- Universal availability
  The cloud and its services are available at any time, as long as there is an internet connection provided.

6.4.2. Cloud software

Operating systems
Nowadays (November 2010) there are some operating systems (OS) specially conceived for cloud computing. Some of these OS are:

- Cloudo[18] is an OS oriented to programmers because it works in a programming environment

- iCube[19] Online Operating System: is a Windows like OS with similar applications as the provided by some Windows OS like Windows XP or Windows 7

- EYE OS[20] which offers a wide range of applications

- Glide OS 4.0[21]

- Andrewmin[22] and Silveos[23] are websites which offer the possibility to try out a cloud based browser desktops without having to install anything onto the computer. The first one is a mixture between Linux, Ubuntu[24] and Apple, the second one is more Windows like. Both of them offer several applications, but the functionality of the applications of the second one is better. Silveos is based on Silverlight

- Windows Azure[25], the own Microsoft Cloud OS

- Amazon Elastic Compute Cloud (Amazon EC2)[26] is a web service that provides resizable compute capacity in the

[18] http://cloudo.com/
[19] http://www.oos.cc/login.html
[20] www.eyeos.org
[21] http://www.glidedigital.com/
[22] http://www.andrewmin.com/webx/
[23] http://www.silveos.com/
[24] http://www.ubuntu.com/
[25] http://www.microsoft.com/windowsazure/
[26] http://aws.amazon.com/es/ec2/

cloud. It is designed to make web-scale computing easier for developers

6.4.3. Online Project management software

There are already several software packages for online project management on the market. Here are only a few of them listed:

- Mavenlink[27] Project Management
  Mavenlink is a cloud-based project management, collaboration and professional services automation suite. The SaaS platform enables professional service providers and their clients to efficiently manage projects from start to finish, including:

  - Collaboration
    A secure workspace for communications, doc sharing & task management.

  - Professional Services Automation
    Time tracking, expense reporting, invoicing & online payments.

  - Networks
    share opportunities & position teams.

- WORKetc[28]
  WORKetc combines CRM, Project Management, Billing and support and more with a powerful automation engine.

- Clarizen[29]
  Collaborative Project and Work Management: One Place to Manage the Projects Resources, Issues, Budgets, Timesheets, Expenses. Clarizen is a leading global provider of collaborative online work management software that allows businesses to easily manage all of their work, projects and resources in a single, simple to use environment. The work management tools facilitate team collaboration and project execution, ensuring data is always up-to-date and aligned with business objectives.

[27] http://www.mavenlink.com
[28] http://www.worketc.com/
[29] http://www.clarizen.com

- HyperOffice[30] Online Business Collaboration
  This suite offers growing businesses a single online stop of all the essential tools teams need to Collaborate, Communicate, and Manage Information from any browser on any desktop, laptop or mobile device.

- Zoho Projects[31]
  Zoho Projects is a web based project management, collaboration and issue tracking software that allows teams to collaborate and get projects done faster

- AtTask Project and Work Management Software[32]
  AtTask is a Project and Work Management solution that provides a 360-degree view of all workplace activities, helping both team members and management alike to better understand and organize their work. With AtTask, managers can evaluate potential and current projects, set sound strategic and financial objectives, validate corporate initiatives, and promote and execute those projects that provide the greatest business value.

- Manymoon[33]
  An Online Project Management Software for Google Users

6.5. Office 365

Microsoft Office 365 for professionals and small businesses is a subscription service that combines the familiar Microsoft Office Web Apps with a set of web-enabled tools. These tools are able to work with the existing hardware and offer robust security, reliability, and control and work in the cloud [15].
Office Web Apps are online companions to Microsoft Word, Microsoft Excel, Microsoft PowerPoint, and Microsoft OneNote that offer a way to access, view, and edit documents directly in the web browser. Office 365 works with the already known software like Word, Excel, OneNote, and PowerPoint [15].

[30] http://www.hyperoffice.com
[31] http://www.zoho.com/projects/
[32] http://go.attask.com/content/SEM-project-management-software?o=GetApp
[33] https://manymoon.com/?

6.5.1. Office 365 possibilities

Office 365 is able to offer many of the functionalities of suites like Office 2010 and many other specific from working in the cloud:

- Edit simultaneously Excel spreadsheets and OneNote notebooks with others in real time, and see exactly who is editing and viewing the documents.
- Access and view file from mobile devices
- Ensure that viewers see files with consistent formatting when they move between Office Web Apps and desktop Office applications.
- Schedule meetings by sharing calendars and viewing them side by side.
- Access the email, calendar, and contacts from nearly any web browser.
- Share large files both inside and outside of the organization with a password-protected website.
- Open and save files stored on SharePoint directly from Word, Excel, and PowerPoint. Access documents in SharePoint from the mobile device.
- Easily design and maintain a professional-looking public.
- Access Services allows managing, sharing and editing online the inventory, product catalogs, customer records or any other Microsoft Access database.
- Microsoft Lync[34] Online helps to find and quickly connect with the right person through instant messaging (IM), Lync video calls, or online meetings from within the Office applications.
- Share the desktop, online whiteboards, and presentations with colleagues and partners inside and outside of the organization.
- Integrate this technology with mobile platforms including iPhone and Windows Phone 7

[34] http://lync.microsoft.com/es-es/Paginas/default.aspx

- Integrate both with Office 2010 and some earlier platforms, as well as Office Live, it's free, web-based extension of its productivity suite

- Works almost seamlessly with Mac OS X[35]

- It's fast. In test there was almost no latency noticed in working in Office 365 even in a 3G Internet connection as slow as 1.11 Mbps

- For $6 per month per user, Office 365 bundles Exchange[36], Outlook[37], SharePoint[38] and Lync (formerly known as OCS) into a turnkey solution for up to 25 people in an enterprise.

Multiple services and products are planned to be included in the cloud for Office 365 like SharePoint, Exchange, Lync and several Office Apps.

6.5.2. Microsoft guaranteed security for Office 365 applications

Microsoft ensures that the applications of Office 365 are safe and reliable. Office 365 safeguards critical data with geo-redundant, enterprise-grade reliability and disaster recovery with multiple datacenters and automatic failovers and a strict privacy policy.
Microsoft Forefront Online Protection helps to protect the organization from spam and viruses. It includes multiple filters and virus-scanning engines.

6.6. Risks of cloud computing

Of course there is a risk involved by working with the cloud. All the data are just somewhere in the cloud and it is necessary to trust that the cloud service provider is going to manage these data carefully. Hacking attacks, data stealing and other activities will probably happen.

Jon Brodkin from infoworld.com[39] based on Gartner studies[40], classifies the cloud computing risks into seven kinds. Gartner says that customers should look for a cloud provider which is willing and able to show his security measures, ask for the qualification of policy makers, architects,

[35] http://www.apple.com/es/macosx/
[36] http://www.microsoft.com/exchange
[37] http://office.microsoft.com/en-us/outlook/
[38] http://sharepoint.microsoft.com
[39] http://www.infoworld.com/d/security-central/gartner-seven-cloud-computing-security-risks-853
[40] http://www.gartner.com/DisplayDocument?id=685308,
http://www.gartner.com/it/page.jsp?id=707508

coders and operators; risk-control processes and technical mechanisms; and the level of testing that's been done to verify that service and control processes are functioning as intended, and that vendors can identify unanticipated vulnerabilities.

Here are seven security issue customer should pay a special attention before selecting a cloud provider:

1) Privileged user access
   Sensitive data processed outside the enterprise brings with it an inherent level of risk, because outsourced services bypass the "physical, logical and personnel controls" IT shops exert over in-house programs. The customer has to ask as much as possible information about the cloud provider experts who are going to be managing the data.

2) Regulatory compliance
   Customers are ultimately responsible for the security and integrity of their own data, even when it is held by a service provider. Traditional service providers are subjected to external audits and security certifications. Cloud computing providers who refuse to undergo this scrutiny are "signaling that customers can only use them for the most trivial functions" according to Gartner.

3) Data location
   The localization of the cloud provider servers (e.g.: another country with different laws) is unknown to the customer. It is important to ask whether the cloud provider agrees to store and process the data in specific jurisdictions, and whether they will make a contractual commitment to obey local privacy requirements on behalf of their customers.

4) Data segregation
   The data from the user are together with data from other users. Encryption of the users data is a effective but not enough. The data have to be segregated from the rest. The encryption procedure has to have been tested by experienced specialist because an encryption accident makes data completely unusable.

5) Recovery
The cloud provider has to know where the data from the user are stored to recover them in case of a disaster. The cloud provider has to be able to replicate data and application infrastructures across multiple sites. Otherwise the cloud provider is vulnerable to a total failure.

6) Investigative support
Illegal data may be stored on the cloud servers and changing all the time the host server, making it almost impossible to track them. This illegal data could also be illegal copies of the customer data. The customer has to ask for the tracking methods the cloud provider uses to find illegal data, if there are any.

7) Long-term viability
Ideally the cloud provider should last forever, but markets develop in unexpected ways and the provider could fail or being absorbed by another one. The main point here is that whatever happens to the cloud provider, the user must be sure that his data remain available. The user has to ask how he could get his data back and if it would be in a format which could be imported into a replacement application. Nowadays there is no established data between cloud providers, which could make it extremely difficult to migrate from one provider to another one.

6.7. Conclusions

Virtual project management is a highly complex task which demands high skills in many fields to the team members and specially to the virtual project manager.
He has to able to have a good and precise overview of the project which has to be done. He has to decide which kind of project is it going to be, who should join his team, how to deal with the budget, the organizations, the deadlines and the cultural problems, the time differences, the tools and the software which have to be used and the new technologies which should help to succeed in the project.
The virtual project manager should have high technical, cultural, organizational and time management skills among others as well as an enormous patience and stress resistance to overcome this task successfully.

Bibliography

[1] G. Horine, *Absolute Beginner's Guide to Project Management 2nd Edition*, Que, 2009.

[2] Dr. Georg Angermeier, *Projekt, Definition im Projektmanagement-Glossar*. http://www.projektmagazin.de/glossar/gl-0059.html (23.09.2010)

[3] P.M. Institute, *A Guide to the Project Management Body of Knowledge (PMBOK Guide): 2000 Edition*, Project Management Institute, 2001.

[4] S.E. Portny, *Project Management For Dummies 3rd Edition*, For Dummies, 2010.

[5] H. Kerzner und I.I.F. Learning, *Project Management - Best Practices: Achieving Global Excellence*, Wiley, 2010.

[6] Mike Rolfes, *Virtual Project Management*, a term paper for MSIS 489 http://www.umsl.edu/~sauterv/analysis/488_f01_papers/rolfes.htm (15.10.2010)

[7] GlobalProjectManagement.org - *Global Project Management Framework*. http://www.globalprojectmanagement.org/index.php?option=com_content&task=blogsection&id=6&Itemid=40 (13.09.2010)

[8] Merriam-Webster, *Methodology. Definition and More from the Free Merriam-Webster Dictionary*. http://www.merriam-webster.com/dictionary/methodology (05.09.2010)

[9] PRINCE2. *PRINCE2 Foundation & PRINCE2 Practitioner Project Management Training - ILX Group plc, UK & worldwide*. http://www.prince2.com/ (16.10.2010)

[10] Cooke, Helen S. and Tate, Karen (2005): "*The McGraw-Hill 36-Hour Project Management Course*", McGraw-Hill, 2005

[11] Office of Government Commerce in the United Kingdom and other countries. *PRINCE2 Process Model, PRINCE2 Process Map, PRINCE2 Processes - ILX Group UK.* http://www.prince2.com/prince2-process-model.asp (02.10.2010)

[12] Swiss Confederation,*HERMES — HERMES – the Swiss project management method*. http://www.hermes.admin.ch/hermes-die-schweizerische-projektfuehrungsmethode-eng?set_language=en&cl=en (07.10.2010)

[13] Swiss Confederation. *HERMES — The HERMES Method*. http://www.hermes.admin.ch/ict_project_management/the-hermes-method?set_language=en&cl=en (07.10.2010)

[14] GoGrid.com Cloud-provider: *Gogrid.com* http://www.gogrid.com/, http://pyramid.gogrid.com/ (23.10.2010)

[15] Microsoft Corporation: *What is Office 365* http://www.microsoft.com/en-us/office365/enterprise/what-is-office365.aspx (14.10.2010)

[16] M. Williams, *The Principles of Project Management*, SitePoint, 2008.

[17] ISO - International Organization for Standardization, *ISO - International Organization for Standardization*, http://www.iso.org/iso/home.html (15.10.2010)

[18] Harvard Business School, *Communicating with Virtual Project Teams/Creating Successful Virtual Organizations - Virtual Communication - HBS Working Knowledge,* http://hbswk.hbs.edu/archive/2122.html (06.08.2010)

[19] Carnegie Mellon University: *CMMI*, http://www.cmu.edu/index.shtml (02.10.2010)

[20] Dale F. Cooper et al, *Project Risk Management Guidelines: Managing Risk in Large Projects and Complex Procurements*, Wiley, 2004

[21] NASA: *CMMI,* http://ti.arc.nasa.gov/news/cmmi-maturity-level2/ (06.10.2010)

[22] Breitenöder, Anna F.: *Sharing in Cross-Cultural Virtual Teams. A study based on the grounded theory method*, Diplomica Verlag GmbH, Hambrug 2009

Figures:

[F1] Wikipedia: *Cloud computing visual diagram* by Benajmin P. Griner, Philip J. Butler http://en.wikipedia.org/wiki/File:Cloud_applications.jpg